1

UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

MICHAEL BUSH; LINDA TAYLOR; LISA TIERNAN; KATE HENDERSON; ROBERT EGRI; KATALIN EGRI; ANITA LOPEZ; MONICA GRANFIELD; ANN LINSEY HURLEY; IAN SAMPSON; SUSAN PROVENZANO; and JOSEPH PROVENZANO, *pro se* Plaintiffs,	)	
VS.	)	C.A. NO. 1:21-cv-11794-ADB
LINDA FANTASIA; MARTHA FEENEY-PATTEN; ANTHONY MARIANO; CATHERINE GALLIGAN; JEAN JASAITIS BARRY; PATRICK COLLINS; DAVID ERICKSON; TIMOTHY GODDARD; and TOWN OF CARLISLE, Defendants.	)	

DEFENDANTS, TOWN OF CARLISLE BOARD OF HEALTH MEMBERS, JEAN BARRY, ANTHONY MARIANO, DAVID ERICKSON, CATHERINE GALLIGAN AND PATRICK COLLINS' ANSWERS TO PLAINTIFFS' FIRST INTERROGATORIES

Interrogatory No. 1

Do you believe you had the legal authority to issue and/or implement the Board of Health's face mask mandate identified in the Complaint? State the basis of your belief, including but not limited to identifying legal and/or other references upon which you relied. If your belief in your legal authority changed over time, state the change(s) in your belief, the date(s) upon which those changes occurred, and the base(s) of the change(s) in your belief. In accordance with Local Rule of Civil Procedure 33.1(b) please produce copies of all documents your answers reference.

Answer No. 1

Objection: The defendants object to Interrogatory No. 1 on the grounds it (1) seeks legal conclusions; (2) seeks opinions or contentions that relate to facts or the application of law to facts before discovery is completed and/or a pretrial conference has been held; (3) seeks information or materials protected by the attorney-client privilege and/or the attorney work product doctrine; (4) makes improper inquiry into legislative and/or administrative motives; and (5) is overbroad and unduly burdensome.

Notwithstanding the objections and limitations set forth above, and without waiving such objections and limitations, the Board of Health responds as set forth below. This answer is

provided on behalf of the Carlisle Board of Health only, the body duly established under Town of Carlisle General Bylaws Article III, Section 3.24, and M.G.L. c. 41, §§ 1 & 2.

The Board of Health believed it had the legal authority to issue and/or implement a mask mandate. This authority is derived from various sources, including, but not limited to: (1) Governor Baker's Order Requiring Face Coverings in Places Where Social Distancing is not Possible, COVID-19 Order No. 31, and any orders, guidance or advisories issued by the Commissioner of Public Health to implement the terms of such Order; (2) Governor Baker's Order Authorizing the Re-Opening of Phase II Enterprises, COVID-19 Order No. 37, and any rules, standards, measures or guidance issued by the Director of Labor Standards, the Commissioner of Public Health and the Secretary of the Executive Office of Energy and Environmental Affairs to implement the terms of such Order; (3) Governor Baker's Revised Order Requiring Face Coverings in Public Places, COVID-19 Order No. 55, and any orders, guidance or advisories issued by the Commissioner of Public Health to implement the terms of such Order; (4) Governor Baker's Further Revised Order Regarding Face Coverings, COVID-19 Order No. 67, and any orders, guidance or advisories issued by the Commissioner of Public Health to implement the terms of such Order; (5) M.G.L. c. 17, § 2A; (6) M.G.L. c. 111, § 31; (7) M.G.L. c. 111, § 104; (8) 105 CMR 300.190; (9) 310 CMR 11.05(1); (10) 603 CMR 27.08(1); and (11) police powers.

The Board of Health reserves the right to supplement this Answer upon the discovery of additional information.

Interrogatory No. 2

Before issuing and/or implementing the Board of Health face mask mandate identified in the Complaint, did you assess whether wearing face masks was safe and effective for preventing the spread of COVID-19? If so, on what date(s) and how did you conduct that assessment, including but not limited to identifying medical or other references upon which you relied. If you conducted such an assessment, what were the findings of your assessment? If you believed wearing face masks was safe and effective for preventing the spread of COVID-19, state the basis of that belief including but not limited to identifying medical or other references upon which you relied. If you believed wearing face masks was safe and effective for preventing the spread of COVID-19 and your belief changed at any time, state the change(s) in your belief, the base(s) of the change in your belief, and the date(s) of that change(s). In accordance with Local Rule of Civil Procedure 33.l(b) please produce copies of all documents your answers reference.

Answer No. 2

Objection: The defendants object to Interrogatory No. 2 on the grounds it (1) seeks opinions or contentions that relate to facts or the application of law to facts before discovery is completed and/or a pretrial conference has been held; (2) is unintelligible as written to the extent it fails to define the terms "assess" and "assessment; (3) seeks information or materials protected by the attorney-client privilege and/or the attorney work product doctrine; (4) makes improper inquiry into legislative and/or administrative motives; and (5) is overbroad and unduly burdensome.

Notwithstanding the objections and limitations set forth above, and without waiving such objections and limitations, the Board of Health responds as set forth below. This answer is provided on behalf of the Carlisle Board of Health only, the body duly established under Town of Carlisle General Bylaws Article III, Section 3.24, and M.G.L. c. 41, §§ 1 & 2.

Pursuant to its authority as set forth above, the Board of Health was mandated to use all possible care to prevent the spread of COVID-19. As part of that mandate, the Board took such actions as it deemed necessary. Among those actions, the Board adopted a mask mandate (by a vote of 5-0) at a public meeting held on August 25, 2021. The mask mandate was adopted in response to an increase in positive COVID-19 cases within the Town of Carlisle and throughout Middlesex County, including break-through cases among those fully-vaccinated. It was based, in part, on guidance from the Massachusetts Department of Public Health and Centers for Disease Control and Prevention, a recommendation from the COVID Task Force, and input from Health Agent Linda Fantasia, Assistant Health Agent Kris Gines, Public Health Nurse Tricia McGean RN. On August 31, 2021, the Select Board voted to support the Board of Health mandate.

The Board of Health revisited and renewed the mask mandate on October 6, 2021. At that time, Board members had updated information from the above sources as well as copies of various mask studies, including:

- Efficacy of face mask in preventing respiratory virus transmission, Travel Medicine & Infectious Disease 36 (May 28, 2020)
- Facial Masking for Covid-19, Perspective (Oct. 29. 2020)
- Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, BMJ Global Health (2020)
- Respiratory virus shedding in exhaled breath and efficacy of face masks, Nature Medicine 26 (May 2020)
- Temporal dynamics in viral shedding and transmissibility of COVID-19, Nature Medicine 26 (May 2020)
- Universal Masking in Hospitals in the Covid-19 Era, New England Journal of Medicine (May

On October 12, 2021, the Select Board agreed to support the Board of Health's decision to renew the mask mandate.

On November 17, 2021 and December 15, 2021, the Board of Health renewed the mask mandate. On February 23, 2022, the Board of Health changed the mask mandate to a mask advisory consistent with guidance from the Massachusetts Department of Public Health and Centers for Disease Control and Prevention .

Records from which the above Answers may be derived or ascertained are enclosed herewith pursuant to LR 33.1(b). Discussions among Board of Health members regarding adoption and renewal of the mask mandate are reflected in the Board of Health Minutes for August 25, 2021, October 12, 2021, November 17, 2021 and December 15, 2021, copies of which are enclosed herewith.

The Board of Health reserves the right to supplement this Answer upon the discovery of additional information.

The undersigned deposes and says that he is the Chairman of the Carlisle Board of Health and a named defendant in the above-captioned action; that he signs these Answers to the Interrogatories for and on behalf of Carlisle Board of Health and is authorized to do so; that the matters stated in the foregoing Answers are not all within his personal knowledge and that he is informed that there is no officer or employee of Carlisle Board of Health who has personal knowledge of all such matters; that such facts are as stated in said Answers which are not within his personal knowledge have been assembled by authorized agents, employees and counsel of said defendant; and that he is informed and believes that the facts stated in said answers are true and so states under the pains and penalties of perjury.

Tony Mariano, Chairman
Carlisle Board of Health

Dated: August 1, 2022

As to Objections:

PIERCE DAVIS & PERRITANO LLP

/s/ John J. Davis

John J. Davis, BBO #115890
10 Post Office Square, Suite 1100N
Boston, MA 02109
(617) 350-0950
jdavis@piercedavis.com

CERTIFICATE OF SERVICE

I, John J. Davis, certify that on August 2, 2022, a true copy of the aforementioned document was served via first class mail on the parties as follows:

Michael Bush
280 Lowell Street
Carlisle, MA 01741

Linda Taylor
879 Concord Street
Carlisle, MA 01741

Lisa Tiernan

116 Lowell Street
Westford, MA 01886

Kate Henderson
559 Lowell Street
Carlisle, MA 01741

Robert Egri
80 Wildwood Drive
Carlisle, MA 01741

Katalin Egri
80 Wildwood Drive
Carlisle, MA 01741

Anita Lopez
51 Bingham Road
Carlisle, MA 01741

Monica Granfield
110 Carlisle Pines Drive
Carlisle, MA 01741

Ann Linsey Hurley
10 Half Moon Hill
Acton, MA 01720

Ian Sampson
315 Fiske Street
Carlisle, MA 01741

Susan Provenzano
80 Mill Pond Lane
Carlisle, MA 01741

Joseph Provenzano
80 Mill Pond Lane
Carlisle, MA 01741

/s/ John J. Davis

John J. Davis, Esq.

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Tuesday, May 11, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/84001487216

Meeting ID: 840 0148 7216
One tap mobile
+13126266799,,84001487216# US (Chicago)
+19292056099,,84001487216# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes

7:15 Old Home Day Planning (Niles Cocanour)

7:30 Reciprocal Hazardous Waste Agreement (Barny Arnold)

7:45 Summer Fun Program (Holly Mansfield)

8:00 Benfield Farms
- Peer Review Consultant Selection
- Research report from Meridian Engineering

Discussion Items

COVID-19 status report
Public Health Excellence Grant
Town Caucus

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - May 25

Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
January 5, 2021 via Remote Participation
7:00 PM

Join Zoom Meeting
https://us02web.zoom.us/j/82419013882

Meeting ID: 824 1901 3882
One tap mobile
+19292056099,,82419013882# US (New York)
Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes

Discussion Items

COVID-19 status report
Personnel Requests
Benfield Status Report

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - July 28, 2020

Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Special Meeting Agenda
January 26, 2021 via Remote Participation
7:00 PM

Join Zoom Meeting
https://us02web.zoom.us/j/86751194223

Meeting ID: 867 5119 4223
One tap mobile
+13017158592,,86751194223# US (Washington D.C)

Dial by your location
+1 929 205 6099 US (New York)

7:00 **Benfield Farms** – Conceptual Plan for System Upgrade (Meridian Engineering)

DISCUSSION ITEMS

COVID-19 Vaccination Clinic Staffing

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Next Meeting: February 2, 2021

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, May 26, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/82189659567

Meeting ID: 821 8965 9567
One tap mobile
+13017158592,,82189659567# US (Washington DC)
+13126266799,,82189659567# US (Chicago)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes 1/19/21 3/23/21; 4/20/21; 4/27/21; and 5/11/21 (pending)

7:15 Reciprocal Hazardous Waste Agreement (Barny Arnold)

7:30 56 Bellows Hill Road – Accessory Apartment (Sabatini)

8:00 Birch Lane Septic Installations and Fees – request to modify (Brem)

Discussion Items

95 Hanover Road – status report
Benfield Farms – status report
COVID-19
- Local Data
- Town Hall Reopening
- Regional Clinic Update
- Local Clinic Discussion

Public Health Excellence Grant
Board of Health Vacancies

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - tbd
Upcoming: Town Meeting 6/6/21; Town Election 6/22/21

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda v.2
Tuesday, February 2, 2021
Remote Participation
7:00 PM

Join Zoom Meeting
https://us02web.zoom.us/j/88651968447

Meeting ID: 886 5196 8447
One tap mobile
+13017158592,,88651968447# US (Washington DC)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes

7:15 60 Garnet Rock – septic system installation

7:30 Continued Public Hearing: 49 Concord Street – septic system upgrade requiring local approval waivers

Discussion Items

COVID-19 report
Personnel Requests - update
FY22 Budget Request - update

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates -

Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, August 11, 2021 v 2
7:00 PM
REMOTE PARTICIPATION

Meeting ID: 874 9423 6919
Join Zoom Meeting
https://us02web.zoom.us/j/87494236919

One tap mobile
+19292056099,87494236919# US (New York)

7:00 Minutes

7:15 Public Hearing - 142 Russell St – Septic System Upgrade
Request for Local Upgrade Approval Waiver
- Distance to wetlands

7:30 **Discussion Items**
COVID-19 status report
- State Guidance
- Carlisle data
- Old Home Day – Mobile Vaccine Unit
- Public Health Nurse access
- BinaxNOW test kits for local public health

Senior Flu Clinic Planning
PFA's – state grant

8:00 Benfield Farms – Septic System Upgrade
- Design Review Comments
- Discussion of Enforceable Agreement
- Fees

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - TBD
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Agenda
Tuesday, February 16, 2021
7:00 PM

Remote Participation

https://us02web.zoom.us/j/87138020098

Meeting ID: 871 3802 0098
One tap mobile
+19292056099,,87138020098# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes -1/19/21; 1/26/21

7:15 60 Garnet Rock Lane – septic system installation
- Status of Certificate of Compliance
- Discussion of Installation Delays with Installer

DISCUSSION ITEMS

COVID-19 General Update
- Vaccination Clinic Update

Goals Workshop – report
FY22 Budget Update (if available)
Personnel Requests
- Health Dept. Staff
- Vaccination Clinic Staffing

Annual Report Preparation

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates -

Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday August 25, 2021
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/86268667814

Meeting ID: 862 6866 7814
One tap mobile
+19292056099,,86268667814# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes

7:15 PH continued 142 Russell Street – septic system upgrade requiring local waiver for setback to wetlands

Discussion Items

COVID 19

- Community status
- Testing and Vaccinations

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 8/25/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Tuesday, March 9, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/83279854137

Meeting ID: 832 7985 4137
One tap mobile
+13017158592,,83279854137# US (Washington DC)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes 10/10/19, 2/16/21

7:30 Benfield Farms – status report from Meridian Engineering

Discussion Items

27 Old East Street – Accessory Apartment Appeal
Open Space & Recreation Draft – comments
COVID-19 report
FY22 Budget
Personnel Request
2020 Community Chest Grant Status Report

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - July 28, 2020

Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday September 22, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86136555525

Meeting ID: 861 3655 5525
One tap mobile
+13017158592,,86136555525# US (Washington DC)
+13126266799,,86136555525# US (Chicago)

7:00 Minutes

Discussion Items

COVID-19 Status Report
Benfield Farms – Septic System Upgrade

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Agenda v 3
Tuesday, March 23, 2021
7:00 PM

Remote Participation

Join Zoom Meeting
https://us02web.zoom.us/j/83210927189

Meeting ID: 832 1092 7189
One tap mobile
+19292056099,,83210927189# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00	Minutes
7:10-7:30	95 Hanover Road – septic system installation (Nouvellon)
7:30-8:15	Benfield Farms – septic system upgrade 7:30-7:45 Plan presentation 7:45-8:15 Board discussion, Q&A
8:15-8:30	27 Old East Street – Accessory Apartment – septic upgrade status
8:30-8:40	Open Space and Recreation Plan – Board comments
8:40-9:00	Other Discussion Items ▪ COVID-19 Updates ▪ Carlisle Public School RTN 3-35688 report from Omni Environmental ▪ Garrison Place – status of Septic Escrow Account, Operations Manual, Sampling Results ▪ Public Health Excellence Grant Opportunity ▪ FY22 Budget Update ▪ Municipal Vulnerability Grant – March 27th Workshop

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates -

Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda v.3
Wednesday, October 6 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/81885830886

Meeting ID: 818 8583 0886
One tap mobile
+13017158592,,81885830886# US (Washington DC)
+13126266799,,81885830886# US (Chicago)

Dial by your location
+1 929 205 6099 US (New York)

7:00 **Minutes**

7:15 75 Peter Hans Road (O'Brien) – request to modify existing Deed Restriction to accommodate new addition

7:30 288 Lowell Street (Guecia) – Deed Restriction request to add rooms

DISSCUSSION ITEMS

COVID-19 –
- Status Report
- Mask Mandate

Glass Recycling Proposition
Fern's Country Store – Water Issue Update

8:00 Benfield Farms Septic Upgrade (To be Rescheduled)

8:05 Garrison Place – discussion of Permit Conditions

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 10/27/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Tuesday, May 11, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/84001487216

Meeting ID: 840 0148 7216
One tap mobile
+13126266799,,84001487216# US (Chicago)
+19292056099,,84001487216# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes

7:15 Old Home Day Planning (Niles Cocanour)

7:30 Reciprocal Hazardous Waste Agreement (Barny Arnold)

7:45 Summer Fun Program (Holly Mansfield)

8:00 Benfield Farms
- Peer Review Consultant Selection
- Research report from Meridian Engineering

Discussion Items

COVID-19 status report
Public Health Excellence Grant
Town Caucus

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - May 25

Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, November 10, 2021 v 2
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/84298206729

Meeting ID: 842 9820 6729
One tap mobile
+13017158592,,84298206729# US (Washington DC)
+13126266799,,84298206729# US (Chicago)

Dial by your location
+1 929 205 6099 US (New York)

7:00 **Minutes**

7:15 Clark Farm Stand – septic system permit

7:45 0 South Street – Senior Residential Open Space presentation

DISSCUSSION ITEMS

Benfield Farms Leach Field Installation – update
PFA's status report
COVID-19 town status

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/1/21, 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, May 26, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/82189659567

Meeting ID: 821 8965 9567
One tap mobile
+13017158592,,82189659567# US (Washington DC)
+13126266799,,82189659567# US (Chicago)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes 1/19/21 3/23/21; 4/20/21; 4/27/21; and 5/11/21 (pending)

7:15 Reciprocal Hazardous Waste Agreement (Barny Arnold)

7:30 56 Bellows Hill Road – Accessory Apartment (Sabatini)

8:00 Birch Lane Septic Installations and Fees – request to modify (Brem)

Discussion Items

95 Hanover Road – status report
Benfield Farms – status report
COVID-19
- Local Data
- Town Hall Reopening
- Regional Clinic Update
- Local Clinic Discussion

Public Health Excellence Grant
Board of Health Vacancies

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - tbd
Upcoming: Town Meeting 6/6/21; Town Election 6/22/21

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Rescheduled Meeting Agenda
Tuesday, November 16, 2021 V2
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86574678913

Meeting ID: 865 7467 8913
One tap mobile
+19292056099,,86574678913# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 **Minutes** 10/27/21

7:15 Clark Farm Stand – septic system permit
(Geoffrey Freeman)

7:45 0 South Street – Senior Residential Open Space Application
(Hancock Engineering – Brian Geaudreau)

8:00 **DISSCUSSION ITEMS**
- Benfield Farms Leach Field Installation – update
- PFA's status report – to be rescheduled

8:10 COVID-19 - town status

NEW BUSINESS

8:40 **Executive Session** pursuant to M. G. L. c. 30A sec. 21(a)(3) to discuss strategy with respect to litigation: Michael Bush et al. v. Town of Carlisle et al., United States District Court for the District of Massachusetts Case No. 1:21-cv-11794-ADB.

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, August 11, 2021 v 2
7:00 PM
REMOTE PARTICIPATION

Meeting ID: 874 9423 6919
Join Zoom Meeting
https://us02web.zoom.us/j/87494236919

One tap mobile
+19292056099,87494236919# US (New York)

7:00 Minutes

7:15 Public Hearing - 142 Russell St – Septic System Upgrade
Request for Local Upgrade Approval Waiver
- Distance to wetlands

7:30 **Discussion Items**
COVID-19 status report
- State Guidance
- Carlisle data
- Old Home Day – Mobile Vaccine Unit
- Public Health Nurse access
- BinaxNOW test kits for local public health

Senior Flu Clinic Planning
PFA's – state grant

8:00 Benfield Farms – Septic System Upgrade
- Design Review Comments
- Discussion of Enforceable Agreement
- Fees

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - TBD
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, November 17, 2021
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/86574678913

Meeting ID: 865 7467 8913
One tap mobile
+19292056099,,86574678913# US (New York)

Dial by your location
+1 929 205 6099 US (New York)
Meeting ID: 865 7467 8913

7:00 **Minutes**

7:15 Clark Farm Stand – septic system permit

7:45 0 South Street – Senior Residential Open Space presentation

DISSCUSSION ITEMS

Benfield Farms Leach Field Installation – update
PFA's status report
COVID-19 town status

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday August 25, 2021
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/86268667814

Meeting ID: 862 6866 7814
One tap mobile
+19292056099,,86268667814# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Minutes

7:15 PH continued 142 Russell Street – septic system upgrade requiring local waiver for setback to wetlands

Discussion Items

COVID 19

- Community status
- Testing and Vaccinations

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 8/25/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Special Meeting Agenda
Tuesday, November 23, 2021
8:00 AM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86121936991?pwd=Sitrd3hMR1F3NFpHMTA2d2V2emd4Zz09

Meeting ID: 861 2193 6991
Passcode: 846379

8:00 **NEW BUSINESS**

Executive Session pursuant to M. G. L. c. 30A sec. 21(a)(3) to discuss strategy with respect to litigation: Michael Bush et al. v. Town of Carlisle et al., United States District Court for the District of Massachusetts Case No. 1:21-cv-11794-ADB.

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday September 22, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86136555525

Meeting ID: 861 3655 5525
One tap mobile
+13017158592,,86136555525# US (Washington DC)
+13126266799,,86136555525# US (Chicago)

7:00 Minutes

Discussion Items

COVID-19 Status Report
Benfield Farms – Septic System Upgrade

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda v.3
Wednesday, October 6 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/81885830886

Meeting ID: 818 8583 0886
One tap mobile
+13017158592,,81885830886# US (Washington DC)
+13126266799,,81885830886# US (Chicago)

Dial by your location
+1 929 205 6099 US (New York)

7:00 **Minutes**

7:15 75 Peter Hans Road (O'Brien) – request to modify existing Deed Restriction to accommodate new addition

7:30 288 Lowell Street (Guecia) – Deed Restriction request to add rooms

DISSCUSSION ITEMS

COVID-19 –
- Status Report
- Mask Mandate

Glass Recycling Proposition
Fern's Country Store – Water Issue Update

8:00 Benfield Farms Septic Upgrade (To be Rescheduled)

8:05 Garrison Place – discussion of Permit Conditions

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 10/27/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday December 15, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86504718312

Meeting ID: 865 0471 8312
One tap mobile +13017158592,,86504718312# US (Washington DC)
Dial by your location +1 929 205 6099 US (New York)

7:00 Minutes: 10/6/21; 11/16/21

7:15 COVID-19 – discussion
- Community Status
- Mask Mandate
- Booster Clinic

8:00 Benfield Farms Septic Upgrade
- FAST Permit Conditions (tentative)
- Progress Report (Beaudry)

8:20 **DISSCUSSION ITEMS**
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - TBD
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, November 10, 2021 v 2
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/84298206729

Meeting ID: 842 9820 6729
One tap mobile
+13017158592,,84298206729# US (Washington DC)
+13126266799,,84298206729# US (Chicago)

Dial by your location
+1 929 205 6099 US (New York)

7:00 **Minutes**

7:15 Clark Farm Stand – septic system permit

7:45 0 South Street – Senior Residential Open Space presentation

DISSCUSSION ITEMS

Benfield Farms Leach Field Installation – update
PFA's status report
COVID-19 town status

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/1/21, 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday January 12, 2022 v.2
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86914001589

Meeting ID: 869 1400 1589
One tap mobile
+13017158592, 86914001589# US (Washington DC)

7:00 Minutes 12/15/21
8/28/19, 8/29/19, 1010/19,12/12/19

7:15 COVID-19
- Community Status
- Mask Mandate
- ARPA Funding
- Remote meetings
- General Updates

7:45 Benfield Farms Septic Upgrade
- FAST Permit Conditions – final draft

DISSCUSSION ITEMS
- FY23 Budget Preparation
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - January 26, 2022
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Rescheduled Meeting Agenda
Tuesday, November 16, 2021 V2
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86574678913

Meeting ID: 865 7467 8913
One tap mobile
+19292056099,,86574678913# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 **Minutes** 10/27/21

7:15 Clark Farm Stand – septic system permit
(Geoffrey Freeman)

7:45 0 South Street – Senior Residential Open Space Application
(Hancock Engineering – Brian Geaudreau)

8:00 **DISSCUSSION ITEMS**
- Benfield Farms Leach Field Installation – update
- PFA's status report – to be rescheduled

8:10 COVID-19 - town status

NEW BUSINESS

8:40 **Executive Session** pursuant to M. G. L. c. 30A sec. 21(a)(3) to discuss strategy with respect to litigation: Michael Bush et al. v. Town of Carlisle et al., United States District Court for the District of Massachusetts Case No. 1:21-cv-11794-ADB.

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V 2
Monday January 24, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/86926925602

Meeting ID: 869 2692 5602
One tap mobile
+19292056099,,86926925602# US (New York)
+13017158592,,86926925602# US (Washington DC)

7:00 Minutes: 1/12/22 (tentative)
Board of Health Commuication

7:15 COVID-19 – discussion
- Community Status
- Revised Guidance
- Community Events
  - Gleason Library (Martha Patten-Feeney)

8:00 Clark Farm Stand – Water Supply Question

DISSCUSSION ITEMS
- Liaison Reports
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - TBD
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, November 17, 2021
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/86574678913

Meeting ID: 865 7467 8913
One tap mobile
+19292056099,,86574678913# US (New York)

Dial by your location
+1 929 205 6099 US (New York)
Meeting ID: 865 7467 8913

7:00	**Minutes**
7:15	Clark Farm Stand – septic system permit
7:45	0 South Street – Senior Residential Open Space presentation

DISSCUSSION ITEMS

Benfield Farms Leach Field Installation – update
PFA's status report
COVID-19 town status

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V2
Wednesday February 9, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/89018024555

Meeting ID: 890 1802 4555
One tap mobile
+13126266799,,89018024555# US (Chicago)
+19292056099,,89018024555# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Community Input

7:05 COVID-19 – discussion
- Community Status
- Mask Mandate Discussion

7:30 Benfield Farms –
- Indoor Air Quality Complaint
- FAST Start-Up report

DISSCUSSION ITEMS

ARPA Requests - update
PFA's status update
Minutes: 1/24/22
Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 2/23/22
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Special Meeting Agenda
Tuesday, November 23, 2021
8:00 AM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86121936991?pwd=Sitrd3hMR1F3NFpHMTA2d2V2emd4Zz09

Meeting ID: 861 2193 6991
Passcode: 846379

8:00 **NEW BUSINESS**

Executive Session pursuant to M. G. L. c. 30A sec. 21(a)(3) to discuss strategy with respect to litigation: Michael Bush et al. v. Town of Carlisle et al., United States District Court for the District of Massachusetts Case No. 1:21-cv-11794-ADB.

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/15/21
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday February 23, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/87550874312

Meeting ID: 875 5087 4312
One tap mobile
+13126266799,,87550874312# US (Chicago)
+19292056099,,87550874312# US (New York)

Dial by your location
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington DC)
+1 346 248 7799 US (Houston)
+1 669 900 6833 US (San Jose)
+1 253 215 8782 US (Tacoma)

7:00 Community Input

7:05 COVID-19 – discussion
- Community Status
- Mask Mandate Discussion

7:30 PH 147 Westford Street – septic system upgrade requiring Local Waiver
- 15.211 Distances – leaching area 91’ from wetlands, 100’ required

DISSCUSSION ITEMS
- FY23 Budget Update
- PFA’s status report
- Minutes: 2/9/22
- Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 3/9/22
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday December 15, 2021
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86504718312

Meeting ID: 865 0471 8312
One tap mobile +13017158592,,86504718312# US (Washington DC)
Dial by your location +1 929 205 6099 US (New York)

7:00 Minutes: 10/6/21; 11/16/21

7:15 COVID-19 – discussion
- Community Status
- Mask Mandate
- Booster Clinic

8:00 Benfield Farms Septic Upgrade
- FAST Permit Conditions (tentative)
- Progress Report (Beaudry)

8:20 **DISSCUSSION ITEMS**
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - TBD
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V 2
Wednesday March 23, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/83860206671

Meeting ID: 838 6020 6671
One tap mobile
+13126266799,,83860206671# US (Chicago)
+19292056099,,83860206671# US (New York)

Dial by your location
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington DC)

7:00 Community Input

7:05 COVID-19 - community status

7:15 Town Meeting COVID Planning – Wayne Davis, Moderator

7:30 Ferns Country Store – Public Water Supply update (Herweck)

DISSCUSSION ITEMS

Financials
- 53E Revolving Cap
- FY23 Operating Budget – staffing
- FY21 Year End Memo

Minutes: 3/9/23
Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 4/6/22
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday January 12, 2022 v.2
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/86914001589

Meeting ID: 869 1400 1589
One tap mobile
+13017158592, 86914001589# US (Washington DC)

7:00 Minutes 12/15/21
8/28/19, 8/29/19, 1010/19,12/12/19

7:15 COVID-19
- Community Status
- Mask Mandate
- ARPA Funding
- Remote meetings
- General Updates

7:45 Benfield Farms Septic Upgrade
- FAST Permit Conditions – final draft

DISSCUSSION ITEMS
- FY23 Budget Preparation
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - January 26, 2022
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, April 6, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/83283607771

Meeting ID: 832 8360 7771
One tap mobile
+19292056099,,83283607771# US (New York)
+13017158592,,83283607771# US (Washington DC)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Community Input

7:05 COVID-19 – Community Status

7:15 Fern's County Store- Food Establishment Permit

DISSCUSSION ITEMS

Benfield Farms

- Septic Upgrade Status Report
- Indoor Air Quality Update
- Health Survey

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - April 20, 2022Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V 2
Monday January 24, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/86926925602

Meeting ID: 869 2692 5602
One tap mobile
+19292056099,,86926925602# US (New York)
+13017158592,,86926925602# US (Washington DC)

7:00 Minutes: 1/12/22 (tentative)
Board of Health Commuication

7:15 COVID-19 – discussion
- Community Status
- Revised Guidance
- Community Events
  - Gleason Library (Martha Patten-Feeney)

8:00 Clark Farm Stand – Water Supply Question

DISSCUSSION ITEMS
- Liaison Reports
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - TBD
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

COVID TASK FORCE
Agenda
Monday, August 23, 2021
7:00 PM

Remote Participation

Join Zoom Meeting
https://us02web.zoom.us/j/89671387033

Meeting ID: 896 7138 7033
One tap mobile
+19292056099,,89671387033# US (New York)
Dial by your location
+1 929 205 6099 US (New York)

7:00 **NEW BUSINESS**

- Community COVID Status
- Wearing of Face Covers
- General Information.

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V2
Wednesday February 9, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/89018024555

Meeting ID: 890 1802 4555
One tap mobile
+13126266799,,89018024555# US (Chicago)
+19292056099,,89018024555# US (New York)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Community Input

7:05 COVID-19 – discussion
- Community Status
- Mask Mandate Discussion

7:30 Benfield Farms –
- Indoor Air Quality Complaint
- FAST Start-Up report

DISSCUSSION ITEMS

ARPA Requests - update
PFA's status update
Minutes: 1/24/22
Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 2/23/22
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday February 23, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/87550874312

Meeting ID: 875 5087 4312
One tap mobile
+13126266799,,87550874312# US (Chicago)
+19292056099,,87550874312# US (New York)

Dial by your location
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington DC)
+1 346 248 7799 US (Houston)
+1 669 900 6833 US (San Jose)
+1 253 215 8782 US (Tacoma)

7:00 Community Input

7:05 COVID-19 – discussion
- Community Status
- Mask Mandate Discussion

7:30 PH 147 Westford Street – septic system upgrade requiring Local Waiver
- 15.211 Distances – leaching area 91’ from wetlands, 100’ required

DISSCUSSION ITEMS
- FY23 Budget Update
- PFA’s status report
- Minutes: 2/9/22
- Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 3/9/22
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday March 9, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/82449457194

Meeting ID: 824 4945 7194
One tap mobile
+13017158592,,82449457194# US (Washington DC)
+13126266799,,82449457194# US (Chicago)

7:00	Community Input
7:05	Town Meeting Planning (tentative)
7:15	PH cont. 147 Westford Street – septic system upgrade
7:30	55 Lions Gate Road (Zanga) – request for Deed Restriction for basement renovation

DISSCUSSION ITEMS

- FY23 Budget Update
- Benfield Farms
  - Indoor Air Quality resident complaint
  - Septic System Update
- PFA's status report
- Minutes: 2/23/22
- Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - tbd
Upcoming: Town Caucus 3/14/22

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V 2
Wednesday March 23, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/83860206671

Meeting ID: 838 6020 6671
One tap mobile
+13126266799,,83860206671# US (Chicago)
+19292056099,,83860206671# US (New York)

Dial by your location
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington DC)

7:00 Community Input

7:05 COVID-19 - community status

7:15 Town Meeting COVID Planning – Wayne Davis, Moderator

7:30 Ferns Country Store – Public Water Supply update (Herweck)

DISSCUSSION ITEMS

Financials
- 53E Revolving Cap
- FY23 Operating Budget – staffing
- FY21 Year End Memo

Minutes: 3/9/23
Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 4/6/22
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday, April 6, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/83283607771

Meeting ID: 832 8360 7771
One tap mobile
+19292056099,,83283607771# US (New York)
+13017158592,,83283607771# US (Washington DC)

Dial by your location
+1 929 205 6099 US (New York)

7:00 Community Input

7:05 COVID-19 – Community Status

7:15 Fern's County Store- Food Establishment Permit

DISSCUSSION ITEMS

Benfield Farms

- Septic Upgrade Status Report
- Indoor Air Quality Update
- Health Survey

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - April 20, 2022Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V 3
Wednesday April 20, 2022
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/82735665564

Meeting ID: 827 3566 5564
One tap mobile
+13017158592,,82735665564# US (Washington DC)
+13126266799,,82735665564# US (Chicago)

7:00	Community Input
7:05	COVID-19 – updates
7:15	Town Meeting Updates (tentative)
7:30	Recreation Commission – Dog Park Warrant Article
7:45	COVID Guidance – discussion with Carlisle School Administration (to be rescheduled)

DISSCUSSION ITEMS

- Benfield – status report
- Daisy Gasoline Station Monitoring Well Results
- Minutes: 4/6/22
- Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - TBD
Upcoming:

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda V2
Wednesday May 4, 2022
7:00 PM
REMOTE PARTICIPATION

Join Zoom Meeting
https://us02web.zoom.us/j/89592261741

Meeting ID: 895 9226 1741
One tap mobile
+13017158592,,89592261741# US (Washington DC)
+13126266799,,89592261741# US (Chicago)

7:00 Community Input

7:05 COVID – community status

DISSCUSSION ITEMS

- Benfield Farms
  - PHN Health Visits
  - Septic System Update
- Beaver Management
- Minutes 4/20/22
- Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 5/18/22
Upcoming: Town Election 5/10/22

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

COVID TASK FORCE
Agenda
Monday, August 23, 2021
7:00 PM

Remote Participation

Join Zoom Meeting
https://us02web.zoom.us/j/89671387033

Meeting ID: 896 7138 7033
One tap mobile
+19292056099,,89671387033# US (New York)
Dial by your location
+1 929 205 6099 US (New York)

7:00 **NEW BUSINESS**

- Community COVID Status
- Wearing of Face Covers
- General Information.

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

BOARD OF HEALTH
Agenda
Tuesday, January 5, 2021
7:00 PM
Remote Participation
Join Zoom Meeting
https://us02web.zoom.us/j/82419013882
Meeting ID: 824 1901 3882

7:00 Minutes
7:30 **DISCUSSION ITEMS**

- Benfield Status Report
- COVID 19 – Status Report
- 10-Day Emergency Permit (Beavers) – tentative
- FY 21 and FY 22 Staffing Requests - report

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Linda Fantasia Health Agent, , Dave Erickson (recorder), Emily Smith (Carlisle Mosquito), Phil Giffee (NOAH), Mal Nelson (NOAH), Joan Crooker, Maureen Deery, Joseph P, F Vasquez

The meeting was called to Order at 7:02 pm.

1. **Minutes**
   The minutes of August 28, 2019 with corrections that Galligan had already sent to Fantasia were accepted with one abstention. (Barry did not attend)
   The minutes of August 29, 2019 were accepted with one abstention (Barry did not attend).
   The minutes of December 1, 2020 were accepted unanimously.

2. **COVID-19 Status Report**
   Fantasia--as expected Carlisle is having a surge. As of January 5th, there are 117 total confirmed or suspected cases with ages ranging from 2 to 90. Historically, the case count was: March (5), April (2), May (15), June (2), July (5), Aug (4), Sep (3), Oct (8), Nov (15), Dec (55), Jan (3) to date.

   Tricia McGean (PHN) has been able to keep up with contact tracing but using the Community Tracing Collaborative more. A second round of CARES Act funds will continue through 12/31/21.

   The Council on Aging is suspending haircuts in January in light of the upsurge in COVID cases in Carlisle.

   The Governor has rolled back the reopening guidance to Phase 3 Step 1. This means smaller indoor and outdoor gatherings and lower occupancy rates for buildings. Great Brook Ski Touring Center revised their plan—the barn is not open for rental equipment. They are getting more visitors so they will have more monitors in the parking area. They are trying to do whatever is necessary to keep people safe while still continuing to operate.

   The fire department is doing 40-50 COVID test/day and that will continue for a while. The test is free for residents and workers in Carlisle. The BOH received a small grant to help with the testing costs to the town.

The COVID-19 refrigerator has been moved to the Police Station garage which has 24/7 security. The new TempStick temperature monitoring device is operational and needs to calibrate for 24 hours.

The state has added anyone 75 or older to Phase I. There are many questions about who is considered an essential worker and where they fit in the vaccination guidance. The categories are changing constantly. Carlisle is cosponsoring a closed clinic with Concord on January 14, 15, and 16 for First Responders. Volunteers who work the clinic will be considered essential so they can get their shot. They should be aware that it takes about 2 weeks to start developing antibodies but they will get reasonable protection even without the second shot. At this point the second tier (including educators and those 65 and older) should start in February or March. Fantasia--if a vial is open, it should be used preferably on someone in a higher priority category. The state does not want vaccine to be wasted.

3. COVID-19 staffing

Mariano--said the Vaccine Advisory Group (VAG) agreed that there is a need for a technical coordinator, that is, someone who will manage the on the ground procedure of these clinics. This will be someone who can move things to where they need to be, check-in volunteers, put out personal protective equipment, and provide general assistance in the daily operation of the clinic. The BOH has a candidate and Thorsen volunteered to interview the person.

Galligan asked whether this will be a paid position and what would be required to get it funded. Mariano said it is not yet funded. The Town will first need to determine whether the position would be eligible under the various COVID funding sources.

Fantasia (Health Agent) will be the Vaccination Clinic Coordinator) and Kris Gines (Assistant to Health Agent) will be the backup clinic coordinator. Dr. Jean Barry will be the Medical Director. Gines and Fantasia what roles the will be responsible for but either one would be capable of doing the job of Vaccination Coordinator... Fantasia has talked with Gines and she is interested but she is also working her regular job in the Health Department. The BOH needs to decide on how they want the staff to use their time. Galligan thinks Gines is the logical person and has the proper skill set to be backup coordinator and she thinks it is the most effective thing to do. The Health Department is already triaging its work so the Selectmen need to understand that health needs resources for COVID-19 as well as the work currently being set aside. Fantasia brought up bringing in an outside coordinator—there was some discussion of this but the feeling seemed to be that it might be difficult to find such a person and even if they were available to hiring process would take time and funding could be an issue. The possibility of supplementing the current staff was raised; Galligan has done a lot of field work and suggested having an overall Vaccine-Clinic Coordinator (or as Thorsen describes it, a Lab Manager position). The preference is to to continue with Fantasia and Gines in this role.

Barry brought up the issue of letting the town know the plans. Unfortunately, there is very little detailed information on phase 2. The BOH does not want to give out inaccurate information. The BOH agreed that it is important to inform residents that clinics are being planned but there are no details yet. As soon as information becomes available the BOH will share it with the public. Barry will prepare and FAQ.

Mariano brought up the need to talk about liability protection for volunteers. Fantasia sent out a good summary of current protections.

4. Benfield Status Report

Mariano said that there are 2 issues with Benfield, heat and water. He said heat has largely been resolved (heat exchanger equipment was repaired and recharged with Freon and a coil has been ordered for a unit for the common areas). Because there were no violations of the MA sanitary code pertaining to housing, is not

really a BOH issue. It was mentioned that the system may only be able to heat to 69, regardless of the thermostat reading, if it is really cold (this temperature is still compliant with the sanitary code).

In terms of water damage, the Building Inspector had gone out and found water damage around the threshold of a third-floor door. This condition (moisture) does come under the sanitary code and the Health Department is coordinating with the Building Department. The sub sill was rotted and has been repaired. Since the repairs there was no water leakage in the first rain but there was some leakage in a subsequent rain, with water pooling and leaking into the library and common community room on the second floor. Benfield staff reported that the door seemed to have been damaged between last Friday and Saturday and is now split and needs to be repaired. There have also been occasions where the door has been left open—there is hope of installing a camera to get a better idea of what is happening; also there is an issue with the tilt of the porch outside the door that should be rectified.

5. **Beavers -** There was no discussion.

6. **FY 21 and FY 22 Staffing Requests**
Mariano, Galligan and Fantasia went before the Select Board (SB) to request a permanent public health nurse position. Thanks to the work Galligan and Fantasia did there was a lot of deliberation but the SB are putting off a decision until January 12th, in general the reception was not as positive as had been hoped.

The BOH would also like to increase the hours of the Assistant to the Health Agent from 24 to 35 hours/week. There was discussion about the how the growth of projects and project complexity and increased popularity of accessory apartments in the town is putting more load on the BOH but, unlike other town committees, funding for the BOH has been basically flat for the last several years. Last year a request for a Public Health Nurse was rejected and funds to increase staffing have been difficult to obtain. There is a COA employee looking for an additional hours/week. Fantasia will follow up to see if they are interested.

There is a Selectboard meeting next week and Mariano suggested that people interested in the BOH might attend that meeting to advocate for the BOH. They will need to request the Zoom details.

7. **Other**
The FY22 budget is due on January 18. Fantasia, Gines, and Galligan are working on it.
Fantasia is in the process of filing the vaccine agreement with the state and completing online training for Prep Mod and MIIS. [Note: Prep Mod is the state's online, paperless system that local health departments can use at immunization clinics to schedule, screen, bill and report to the Massachusetts Immunization Information System (MIIS).]

Adjourned: There was no further business discussed. Meeting Adjourned at 20:52,

The next meetings are January 19th and February 2nd.

Respectfully submitted,

David Erickson,
Recorder

(All documents discussed during this meeting are available for review upon request in the office of the Board of Health)

BOARD OF HEALTH
MEETING MINUTES
Tuesday, January 19, 2021
7:00 PM
Remote Participation

Join Zoom Meeting
https://us02web.zoom.us/j/83166602293
Meeting ID: 831 6660 2293

7:00 Minutes
7:15 PH 49 Concord Road (Sillers) – upgrade of failed septic system requiring waivers.
DISCUSSION ITEMS and NEW BUSINESS

- 60 Garnet Rock Lane – septic system installation
- FY22 Budget Request
- Personnel Requests

7:40 Benfield Farms – Report from Meridian Engineering on Septic System Upgrade

---

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Linda Fantasia Health Agent, Dave Erickson, Mal Nelson, Emily Smith (Carlisle Mosquito), Phil Giffee, Sylvia Sillers, Susan Blankenship, Paul Kirchner

The meeting was called to Order at 7:00 pm.

1. **Minutes**—minutes from 9/11/20, 12/15/20, and 1/5/21 were approved with corrections which will be emailed to Fantasia who will update the minutes accordingly.

2. **PH 49 CONCORD ROAD – Septic System Upgrade. It was moved (Galligan) and seconded (Barry) to open the public hearing. Motion passed unanimously.** Paul Kirchner of Stamski & McNary attended on behalf of the applicant Sylvia Sillers. Since the plan was still under review by Rob Frado, Kirchner asked for a continuance to the next meeting. It was moved (Barry) and seconded (Galligan) to continue the hearing until 2/2/21. Motion passed unanimously.

3. **Benfield Farms – present Phil Giffee (NOAH), Mal Nelson (Property Manager)**

   Mariano moved Benfield farms up on the Agenda since Giffee and Nelson were already present, and it was not a public hearing. The plans and narrative had only recently been emailed to the Board. Mariano said he had not had time to look at it and since Beaudry was not present, he proposed delaying the Benfield report until 2/2/21. Mariano raised the question of the timely submittals so that Rob Frado has enough time to do his review. Fantasia said an initial review takes 14 days even for a conceptual plan. Giffee said that a lot of work has been done but more discussion with Frado is needed. It was suggested that the BOH hold a special meeting as soon as possible so work can begin in the spring. Mariano said that it was important to coordinate with the ConsComm. Galligan noted that Frado's role is to review the design, not help create it. As the consultant for the local approving authority (the Board) he cannot be involved in the design work. Discussion of conceptual plans should happen with the Board. Mariano is looking for specific timelines for

the final design. The Board is concerned that NOAH does not appreciate the urgency of the situation. Giffee assured the Board that NOAH wants the problem resolved as soon as possible.

Fantasia asked about the moisture problem. Nelson had a contractor come out last Thursday (1/14/21) who said that based on what he saw the door needs to be replaced. The threshold has already been replaced in-house. There is also a leveling issue, the contractor needs to determine how best to prevent pooling and ensure that water drains--he should have a proposal by Friday 1/22/21. Mariano asked whether there is an issue at this time or whether it is a band aid solution. Nelson said that yes it may be a short term solution but there have been two storms with no leaking on the first storm and some leaking on the second storm. Nelson will look at what else can be done until they can get the contractor out. Galligan noted that both storms had a lot of wind and the fact that there was only leakage on the second storm suggests they are going in the right direction. Giffee said that once the leakage has been resolved any inside problems (plaster, damage to 2nd floor ceiling, etc.) resulting from the leakage will be corrected. There was no further discussion. Nelson and Giffee left at 7:46pm.

4. 60 Garnet Rock Lane

Fantasia has not heard from the installer for 2 weeks. The septic installation was to have been completed by December 15 but so far, they only have the bottom of the bed has been dug and approved. The homeowner needs to pump every week which is clearly not sustainable, especially since there are no guarantees that nothing is going out from the septic tank. Galligan observed that the history of winter installations is that timely completion is promised but frequently doesn't happen. Nevertheless, completion of this system needs to be resolved quickly.

Sending a warning letter/reprimand to the installer was discussed; this warning would be a first step before taking the installer off the BOH list of approved contractors. After one warning the Board can pull the license to install systems in Carlisle, but since it would be important to finish any outstanding jobs any action on pulling a license would likely be delayed until next year. Since the bed is in place, the recommended course of action is to allow 2 weeks for completion or converting to a tight tank. The number of people living in the house is unknown. Two alternative courses of action were discussed, an enforcement order which requires due process, or an advisory letter spelling out the conditions – 2 weeks for a certificate of completion or revert to a tight tank. To addresses the installer's performance, Fantasia suggested saying that we are going to discuss issuing a warning letter at the next meeting. Mariano provided some history—this installation involved the COVID-related extension of the winter shut down. The installer was supposed to start by Nov 17 and finish by Dec 15. Because of a personal situation the installer was allowed to start after November 1st. The installation progressed only as far as digging out and approval of the bottom of the bed again being delayed for personal circumstances of the installer.

Galligan moved and Barry seconded that an advisory letter be sent out requiring a Certificate of Compliance within 2 weeks or conversion to a tight tank. Passed unanimously.

5. COVID-19

There are currently 135 total cases, up from 117 on 1/5/21. Carlisle currently has a 3.53% positivity rate (which includes Carlisle residents who got tested elsewhere), the State's rate is 5.9%.
We did have the clinic in Concord for EMS on 1/14/21-1/16/21 and it brought up some issues that need to be resolved. There were close to 194 vaccinations on Thursday and a somewhat lower numbers on Friday and Saturday. One issue that became clear was that it would be much better to have the vaccination list arranged

by appointment time rather than alphabetically. With an alphabetic list it was necessary to repeatedly scan the list to estimate counts and attendance whereas if it have been arranged by time it would have been possible to go line by line.

Fantasia completed MIIS (Massachusetts Immunization Information System) and vaccine agreement today. This was done electronically and was approved immediately. Forms for ordering the vaccine will follow later. Carlisle is now eligible to receive vaccine and hopes s to receive vaccine in Jan. Fantasia is looking into hiring a clinic technician/administrator, who would be responsible for opening and closing clinics, managing supplies, and serving as a general resource throughout the clinics. Barry and Jen Derkerzarian are taking care of recruiting volunteers and Burt Rubenstein will train vaccinators. We will start using our own EMTs who are trained in doing injections. The structures for vaccinations should ship today or tomorrow, we did need make a modification of using abutment blocks rather than 39 stakes to hold it down (The Congregational church would probably not appreciate stakes driven into their parking lot). The structures should be here in a week or 2.

For towns doing clinics, the state is requiring participants to do all clinics for the duration of the program, not just sub-groups. Fantasia has had some discussion with other health directors regarding doing single-town or regional clinics. No one feels they can manage a regional clinic for all 5 towns, but we might want to partner with Concord (or other subgroup). Barry, the medical director, is the only unpaid member of staff . On the question of regionalizing or going it alone we should consider that after first responders we must eventually do the entire town, which raises the question of capacity. Galligan suggested that towns could reach out to the state and object to the all-or-nothing policy--the state has changed policy based on feedback before (such as the definition of occupational groups). It's also possible that the job will become easier since CVS and Walgreens may have significant capacity by July. Barry noted that we are assuming that we will do clinics until completion, but the burden may lessen if some residents don't want the vaccine or get it at work or elsewhere. It might not be as big a burden as it seems.

In terms of the clinic administrator, another candidate was recommended by Barry. Fantasia is looking for someone able to carry tables and set up chairs but also has educational experience. A second volunteer could be useful for doing inventories and financials needed for CARES Act reimbursement. Thorsen plans to work 8 hrs/ week and he volunteered to help manage the clinic administrator(s).

Roles and duties for the administrator and others were briefly discussed and will be formalized. Fantasia sees us starting off with paid town staff for the clinics then transitioning to volunteers, ensuring that they are properly trained. That is Concord’s approach; they are only using town employees until they see and resolve any problems.

Fantasia discussed that the BOH has primary responsibility for the vaccination program (i.e., MA DEP has given responsibility for carrying out COVID vaccine clinic duties to local Boards of Health) and this is managed by the Agent (Linda, Kris-back up) with the Medical Director’s input and BOH support. Linda is getting directives from both the LEPC and the Vaccine Advisory Committee (VAC), which needs to be resolved. Linda will reach out to LEPC and VAC about moving the VAC to the BOH instead of the LEPC. Barry and Mariano will draft a memo clarifying that BOH has responsibility for vaccinations for it at the next LEPC and VAC meetings.

.

Other Covid related points:

Thorsen noted that the Moderna vaccine is the likely vaccine for Carlisle because of user-friendly storage requirements. Baker announced that Massachusetts is getting about 44000 doses of Moderna vaccine per week. This week 10,000 doses are going to CVS/Walgreens--mostly to Fitchburg and Worcester high impact areas. Next week there will be a roll out to supermarkets—Wegmans and Stop & Shop. This follows the flu vaccine administration model.

Carlisle has a number of decisions to make for its clinics, such as accepting insurance for administering the vaccine ($17 shot #1, $28 for shot #2) or having a wait list (feature in PrepMod).

6. **FY22 budget request**

The BOH FY22 request for additional staffing was put off again, the selectmen will send a list of questions for the BOH to answer. So far, those questions have not been received. The Board discussed their general feeling that Health employees had been unfairly attacked at the BOS meeting and it was agreed to submit a letter to the Select Board objecting to this sort of behavior in public meetings.

The meeting adjourned at 21:36. There is a meeting with Fincom on 1/25 at 5:00pm, a special BOH meeting on 1/26, and the next regular BOH meeting on 2/2/21.

Respectfully submitted,

David Erickson,
Recorder

(All documents discussed are available for review in the office of the Board of Health)

BOARD OF HEALTH
Special Meeting Minutes
Tuesday, January 26, 2021
7:00 PM
Remote Participation
https://us02web.zoom.us/j/86751194223
Meeting ID: 867 5119 4223

AGENDA

7:00 Benfield Farms Conceptual Plan for System Upgrade (Meridian Engineering)

DISCUSSION ITEMS

COVID-19 Vaccination Clinic Staffing

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Linda Fantasia Health Agent, Mark Beaudry (Meridian Associates), Bev(?), Maureen Deery, Dave Erickson, Rob Frado(Technical Consulting Group), Phil Giffee (NOAH), Mal Nelson
The meeting was called to Order at 7:00 pm.

1. **Review of Benfield Farms Conceptual Plan for System Upgrade**

Meridian Associates did soil testing at Benfield Farms in October and December. They started by testing in the primary septic area where they found the soils not suitable so they moved on to testing the reserve area. They noticed inconsistencies with the testing done in 2003 (the 2003 testing was not done by Meridian). While the Northern part of the reserve area was unsuitable (around 18min/inch) they did find soils in the lower part of the reserve area (5 min/inch or better, although they did not find soils with 2min/inch as indicated in 2003). The soils were variable across both the primary and the reserve areas. They were able to basically duplicate the current design in the reserve area, although they needed to rotate it some to keep it within suitable soils and in the easement area. They saw a seasonal high water table 64"-68" below grade, which was a little higher than 2003 but fairly consistent.

Beaudry sent the Soil Evaluation Logs to Fantasia today confirming all the test pits and ground elevations. Beaudry also sent Fantasia two versions of preliminary septic plans. In Plan A, the elevations were based on a mound of .9' which Meridian had calculated in 2013 or 2014. Mariano asked about the .9' mounding versus an earlier analysis calculating 2.6' mounding. Beaudry said that the 2.6' mounding was based on the Title 5 Minimum Required Design Flows of 3900 gallons/day (design flow) whereas the observed average flow is 1045 gallons/day with a peak of 1369 gallons in 2018 and 1800 gallons in 2019. In response to a question by Frado, Beaudry said he does not expect these flows to increase because of water conservation requirements. Beaudry realized that he made a mistake in the calculations. He had shown a 2' separation to groundwater whereas the BOH under Local Upgrade Approval could waive the normal 4' separation to 3' it cannot waive it to 2'. Beaudry noted that the Perc-Rite tubing runs do not necessarily need to be level. A mound above ground level elevations, such as shown in Plan B, would need a Conservation Restriction (CR) change. Beaudry asked for feedback from the Board, since he would be going to the ConsCom meeting later in the week. Beaudry also noted that adding an aeration unit to the FAST pretreatment system will improve the quality of the effluent coming into the field from the pretreatment system.

Frado said that the contractor should be told to remove restrictive features (such features are a large part of the reason for the failure of the current system). Beaudry mentioned that someone asked if the system could be done on the recreation land. Beaudry's understanding at the time was that there was a Conservation

Restriction on the rec land but that is not the case. Still, the rec land is heavily wooded and Beaudry feels it would be expensive putting the system on the rec land. He was asked to look into that and provide more details on what expenses would be involved, it was noted that the expense could help justify a waiver to go to 3' separation. Frado asked whether the board was resigned to living within the CR. Galligan was not resigned to that; she understands that it would take time to modify the CR but she doesn't get the impression that the soils in the reserve area are as good as might be hoped. She is also unclear whether aeration with the FAST unit will work as well as hoped and noted that while they expected Micro C to take care of the problems earlier, it has not. She is also reluctant to grant a waiver because of the past problems with the operation and maintenance of the system including filing timely reports, replacing missing bolts and addressing excessive noise in the blower. Beaudry noted that the idea of aeration came from the independent consultant (Onsite Engineering, Inc). He went on to note that the Micro C system took care of nitrogen issues but led to a carbon surplus which led to BOD (Biochemical Oxygen Demand) issues. The aeration is designed to take care of the BOD issue. Mariano noted that regardless of the source of design suggestions, the ultimate design will be Meridian's and not a third party consultant. Beaudry felt the relief being requested for the 3' offset to groundwater was minimal and allowed under Title 5.

Giffee thinks that since they have taken over management of the system, it has been running well. Fantasia suggested it is worth exploring how rigid the restrictions are so that it might be possible to build the system without a waiver, especially since this is a matter of public health. Beaudry shared the CR document with the Board and noted that whereas some of the language related to existing ground elevations is very precise, it also refers to a "maximum feasible" elevation over the soil absorption field. Beaudry interpreted the spirit of the CR as having more flexibility. This might also apply to the restrictive easement which is actually a rider to the CR and which could possibly be enlarged. It was agreed that Beaudry would bring these issues up with ConsCom and consult back with the BOH before proceeding to a final design.

Barry asked why there was disagreement in the soil testing logs. Beaudry said that soils do not change but there may be a buildup of the biomat resulting in the restrictive layer in the field. Beaudry then provided additional details on the proposed design and the possibility of using the pump chamber for the aeration unit which could be a smaller FAST unit.

In order to move forward, the Board agreed to require the following information:

- A decision from the Conservation Commission on changes to the grade under the CR to eliminate the need for a waiver on the separation to groundwater
- Estimated cost of locating the system on Recreation Land
- Legal Opinion on whether the Restrictive Easement can be enlarged
- Progress report mid-February and Design by the end of February

Galligan said it should not be assumed that the Board of Health is willing to grant the waiver on separation to groundwater. It is important for the Conservation Commission to understand this. The Board of Health decision will be based on safety of the public health and environment. Fantasia suggested that Beaudry contact the Conservation Administrator about the Board's concerns so that the Commission will be prepared to respond at their meeting. Frado agreed the CR may be open to interpretation. He said the primary role of the Board is to protect the public health. Galligan suggested that the intent of the CR focused on the location of the primary field and not necessarily the reserve area. Frado and Board members were in agreement that public health should pre-empt a land use restriction. All parties agreed that the soils at Benfield were just adequate and not very good. This is reason to proceed carefully with a replacement system. Frado agreed that with poor soils the Board should err on the side of caution, especially because it is a large system. He also disagreed that the system will always have limited flows. There was no guarantee that the system will

not need to function at full capacity at some point in the future. The question was asked why a conventional system was not being considered. Frado said either way the system will require pressure dosing because of its size. Fantasia was concerned that the proposed design is the same configuration as the failed system – a FAST pre-treatment and a Perc-Rite leaching area. Beaudry said by using the same types of I/A systems they will be able to re-use some of the components. He is confident in proposing the two I/A systems.

Maureen Deery, Benfield resident and Carlisle Housing Trust (CHT) member, said there are flow limits placed on Affordable Housing. She also asked that the CHT Chair, Kate Reid, be kept informed of the Board's meetings on Benfield. The CHT is considering placing an Article on the Town Meeting Warrant to help with some of the costs of replacing the system. It will be important to have an idea of the potential costs. Mariano said he had spoken with Reid about tonight's meeting.

Beaudry thanked the Board for their comments. He does not want to move forward on a final design until he is confident that it can be approved by the Board.

2. COVID-19

Mariano said that there is a lot going on, Barry, Fantasia and Thorsen have been very active with vaccine clinic planning. Fantasia said that the Health Dept. has been granted access to PrepMod, the vaccination sign up system. Carlisle is also enrolled in the state immunization program (MIIS) and has received approval from the DPH Vaccine Unit to receive and administer vaccine. The state is rolling out new guidance on who is eligible to be vaccinated. Gines is preparing information for the website. To order vaccine the town will fill out a survey Monday morning as to the number of vaccine doses required. Unfortunately, towns cannot request more than 100 doses/week. Barry offered to do a press release because it is important to keep people informed. Mariano notes that at 100 doses/week, there will not be enough vaccine to cover any of the top groups quickly. After Phase 1 which includes health care workers, first responders and home health aides, Phase 2 starts with individuals 75+ years of age. There are 423 people in Carlisle who are 75 or older. Since the vaccine will be so limited, Fantasia suggested checking the PHN for a list of the more critical residents in this age group. The Board discussed whether to wait on advising residents about local clinics until there is available vaccine.

Betsy Fell, Mosquito editor, joined the meeting and Barry suggested the Mosquito publish a list of vaccination sites. These are currently listed on the state website. Barry also said hospitals will send out letters to people who are 75 or older. Fell is putting an article in the paper about the vaccine so she could get information from Barry to include in the article.

The vaccine advisory meeting is scheduled for Monday.

Meeting adjourned at 21:04
The next regular BOH meeting will be on 2/2/21.

Respectfully submitted,

David Erickson,
Recorder
(All documents discussed are available for review in the office of the Board of Health)

BOARD OF HEALTH
Meeting Minutes
Tuesday, February 2, 2021
7:00 PM
Remote Participation

Join Zoom Meeting
https://us02web.zoom.us/j/88651968447
Meeting ID: 886 5196 8447

7:00 Minutes
7:30 Continued Public Hearing: 49 Concord Street - septic system upgrade requiring local approval waivers.

DISCUSSION ITEMS

- COVID-19 report
- Personnel Requests - update
- FY22 Budget Request - update

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Fantasia Health Agent, Dave Erickson, Paul Kirchner, Alan Lewis, Lara Lofdahl (Carlisle Mosquito)

The meeting was called to Order at 7:00 pm.

1. **Minutes**— Galligan asked others to look at the minutes from 1/26/21 and the minutes from 1/19/21 have not yet been distributed. Mariano tabled the minutes--they will be addressed at the next meeting.

2. **New Business**
Mariano updated the board on the Benfield presentation by Mark Beaudry to the ConsCom. Mariano and Galligan attended as well as Mark Beaudry and Phil Giffee. ConsCom's reaction was favorable--they recognized that there was a problem to be solved and seemed willing to be flexible about the grade. They decided their next step would be to talk to Town Counsel to see whether ConsCom could take the liberty of adjusting the grade. There was some back and forth after that because the proposed grade was based on .9' water mounding and Beaudry gave the impression that BOH had approved a .9' mounding design. In fact, that decision has not yet been made, and this was clearly stated at the ConsCom meeting; so, it is still necessary to consider a design based on a 2.6' mounding. Fantasia wants to remind board remembers that this is a large system with a design rate of 3900 gal/day and anything over 2000 gal/day requires a special ground water mounding analysis and that it is the BOH that has to agree on the analysis. Galligan noted that she had strong reservations in the BOH meeting and the ConsCom meeting because Beaudry was pushing for .9' mounding based on average usage and not on the design rating. Galligan says it is a large development and the BOH should hold to Title 5 without variances; since it is so large it can have a big impact on the environment. Galligan expressed reservations and would prefer taking a more conservative approach to the design; she does not think .9' mounding is reasonable and Beaudry is proposing going to 3' separation to groundwater as if it is an entitlement, which it is not. Mariano said we can go into all of this once we have the design. The easement does restrict the available land area so Mariano is unsure they can make a larger field. Galligan responded that the field could extend into the original area and other (possibly more expensive) options could be explored. Mariano tended to agree but does think cost is important. It was noted

that non-compliances bring considerable costs to the Health Department, so installation costs are not the only costs to be considered.

3. **7:15 60 Garnet Rock Lane**
At the BOH meeting on January 19, the board decided to issue an advisory letter and request a certificate of compliance, but then the next morning the Health Department was notified that the system was ready for inspection, so no advisory letter was sent. The as-built inspection was completed on Wednesday, January 28 and the last step would have been the final grade inspection on February 2; this was prevented by a snowstorm. Bonica and Frado will decide when to do the inspection. The system is in and hooked up, the only issue is whether to take any further action--Fantasia thinks there is no need for an advisory letter to the owner. The Board asked if Bonica had been working on the system all along; Fantasia reported that the owner had not heard from him. In this installation there was more than a month of the Health Department being put off by Bonica. He has been a licensed installer for years with no issues. Fantasia thinks Frado might think a warning letter is unnecessary at this point. Barry said that since he doesn't seem to be a repeat offender that she would be inclined to be lenient. Galligan thinks he should be present at the meeting but thinks we should still send a letter because BOH made a big exception for a winter system that we didn't want to do. If we don't send a letter, then we have no documentation of poor performance. It was noted that warnings are not taken lightly by installers because this could affect their business. Galligan commented that historically winter installations have not gone well and if we choose no warning, the board needs to be rigorous about not allowing late starts. Mariano will table this until Bonica can be present.

4. **7:31 PH continued: 49 Concord Street – septic system upgrade.**

Mariano noted that at the last meeting a redesign had been submitted with inadequate time for Frado to review it. Kirchner said that Frado has since reviewed it, making some minor changes but nothing of substance. The absorption system has been designed to remain 50' from wetlands and 5' to property line. To accommodate that goal there is an unusual shape to the absorption system (part of which is under the driveway) which is allowed by Title 5. Everything will be done within the lot without going into the right of way. There is a lot of detail provided for the installer as this is a trickier installation. Frado's comments: we were referencing the incorrect note--it now says see note 15 (instead of 16) and the other comment concerned venting. In a pumped system a vent is required but in a gravity system it is unneeded because there is proper airflow to the building stack. Mariano would like to hear Fantasia's review--he notes that Frado has no engineering comments. Fantasia did talk to Frado to ensure that vents were unnecessary. Frado didn't feel he needed to be at meeting. Mariano noted that the major difference is related to a change in the lateral configuration of the absorption system so that it is now partially under the driveway, Kirchner noted that the distribution box is close to the drive but not under it. Mariano asked whether Frado was ok with the stabilization fabric. Fantasia has sent the plan to Willard and attended a ConsCom meeting, there was a red line change, but it does not require another hearing. The only waiver needed from the BOH is allowing 50' to wetlands and 5' to the property line. There were no public questions.

Fantasia pointed out that the complex design will require careful attention by the installer and may merit special actions by the board to insure proper installation. Fantasia and Kirchner discussed the staking out of the system for the installer, and Fantasia commented that we would want to ensure the stakeout is very detailed because there is so little leeway for error. Fantasia said Frado could approve the stake out as a separate inspection. Fantasia said maybe it should not be included in the motion, but she will check with Frado and if he wants to go out more often, he might. Galligan noted that if Frado does go out additional times that we would have to charge for that.

It was moved (Galligan) and unanimously approved to close the Public Hearing.
It was moved (Galligan) to approve the proposed septic system upgrade for 49 Concord Street and grant the following waivers: 50' distance to wetlands (100' require); 5' distance to property line (10' required; conditional upon approval by the Conservation Commission and additional staking of the lines by the engineer to ensure proper installation. Motion was seconded and approved unanimously.

5. **Carlisle Hazard Mitigation Plan**
Linda reminded the BOH members that there is a Municipal Vulnerability Preparedness (MVP) meeting on February 9. This group was established and has a grant to consider impacts of climate change and where the town is vulnerable. For example, the need for shelters, or drought conditions that could cause wells to dry up and prompt a need for a community water supply.

6. **COVID-19**
Barry (medical director) is cc-ing everyone on the board when updating timing. The first batch of 100 vaccine doses was ordered and should be here by next Wednesday at the latest. The first clinic is set for Feb. 13th. The tent is in transit and Mariano says that Police Chief John Fisher believes it should be ok even in the worst case.
Barry suggested prioritizing those 88 years and older initially and trying to finish remaining members from phase 1. Mariano notes that the structure is an important part of the planning. Fisher explored backup options with the school and the gym/exercise room seems feasible as a vaccination site with accessibility for the senior community. Fantasia has filed the vaccine request and should hear by Friday on our allocation. New requests have to be filed every Monday. Barry said we now have to keep track of the second doses and suggested scheduling the 2nd dose when giving the first. The state created a color-coded flow chart as a guidance tool – very complex with a rainbow of colors. Gines and Fantasia have been taking training on PrepMod and MIIS (Massachusetts Immunization Information System), on one hand tracking patients and appointments and on the other tracking vaccine. Gines will maintain the MIIS, and Fantasia will be responsible for PrepMod. Massachusetts will do a webinar on administering the vaccine. Fantasia has learned from FEMA that there is funding available for vaccination clinics. Considering that we won't get through phase 2 until the end of March and then we have phase 3, we must be prepared that each phase will result in many more vaccinations. We will be doing clinics for a long time unless people start getting the vaccine through primary care or other clinics. Fantasia would like to hire a clinical coordinator--it is not necessary to go through normal hiring. We might also want to consider compensating Zander Ansara and Colleen O'Connor who are putting in an enormous number of hours. Ansara's and O'Connor's positions could be covered by FEMA. BOH can write a job description and submit costs to the town for reimbursement. Mariano thinks it is a good thing to pursue if it is going to be covered. Come springtime there will be septic installations, Benfield and others and these things cannot be put on the back burner while vaccines will go at least into June. Barry also noted that we may be looking at booster shots in 6 months or so, so we should be prepared for that. Mariano said that is part of what we considered when looking to get hours from a public health nurse--there is going to be fallout. Mariano asked Barry about information on variants. Barry had no information, but it is something to be concerned about. This might become like the flu season, but we really don't know how long protection will last and we won't know for a while.
Galligan asked if we will get >100 doses/week at some point. Fantasia said that when we get a group taken care of the state can add that into federal request but with the upcoming phases there are tremendous numbers involved.
Thorsen asked about 2nd doses and Fantasia said that on the form you can list second doses and it does not count against the 100. Mariano heard that a disproportionate amount was going to minority communities and Mariano wonders if that might affect Carlisle. Fantasia knows the state is concerned because minorities are

not accessing the vaccine. There have been 18,000 doses and 360,000 requests (not sure of time period). Barry says that in the coming months Moderna is looking to ramp up production.
The Board thanked Barry for ccing us on releases to the Mosquito and Barry, Thorsen, Mariano, Fantasia, and Gines for their work on the vaccines & clinics. Mariano commented that we are on the verge of realizing these things and we have a group of people who are passionate, educated and prepared right down to tablecloths--there are a lot of people managing this stuff.

Mariano asked Fantasia what we know about FEMA money--does it move on after or even to phase 3? Fantasia thinks it goes to end of year if not into 2022. Fantasia would like to put together a job description for clinical coordinator and also 2 part time volunteers and by next meeting will find out the process to get it through the town.

7. **FY22 budget request**
Mariano said that we have to wait until Fincom deliberates on department budgets and communicates to the Select Board. Galligan said the message from Fincom was that the Health Department information was comprehensive, and they did not have additional questions.

Fantasia will be interviewed by the Concord-Carlisle Community Chest as they are doing their long-term planning. It's unlikely we would receive another grant; we could apply but the Community Chest generally doesn't provide long-term support for the same requests. Fantasia thinks we have used a small amount of the current $10,000 Community Chest grant. A challenge is that human resources to oversee grant work are limited in the Health Department because of COVID. The Board discussed the many consequences of COVID, such as opioid usage and increased teen age suicides, and the possibility of using grant fund for such topics. COA is reorganizing and they have a social worker who is going from part to full time--could we pay for that additional time with the grant money? Is there a role for the library, such as the social worker holding a zoom program for teens or the library and social worker working together to provide zoom programs? Perhaps work could be done with the school psychologist because kids are stressed out. Galligan said the Community Chest has been very generous so she would not be averse to giving money back, but if it's feasible to develop programs it seems like there is a tremendous need.

The meeting adjourned at 20:30. The next meeting will be 2/16/21 (by which time we should have the Benfield design) and 3/2//21.

Respectfully submitted,

David Erickson,
Recorder

(All documents discussed are available for review in the office of the Board of Health)

BOARD OF HEALTH
MEETING MINUTES
Tuesday, February 16, 2021
7:00 PM
Remote Participation

Join Zoom Meeting

Meeting ID: 871 3802 0098
7:00 Minutes 1/19/21; 1/26/21
7:15 60 Garnet Rock Lane – septic system installation
- Status of Certificate of Compliance
- Discussion of Installation Delays with Installer

DISCUSSION ITEMS

COVID-19 General Update
- Vaccination Clinic Update

Goals Workshop – report
FY22 Budget Update (if available)
Personnel Requests
- Health Dept. Staff
- Vaccination Clinic Staffing

Annual Report Preparation

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Fantasia Health Agent, Dave Erickson, Michael Joseph

The meeting was called to Order at 7:00 pm.

1. **Minutes**—the minutes from 1/19/21, 1/26/21, and 2/2/21 were approved with some amendments.

2. **60 Garnet Rock Lane**
This system was allowed to start late with the installer's agreement that it would be completed by 12/17/2020. The rough excavation was approved 12/2/20. Subsequent construction and requests for the next three inspections did not occur in a timely manner and the installer did not respond to outreach by the Health Department (pump chamber, tank and leach field inspected 1/20/21, force main inspected 1/27/21, and rough grade inspected 2/3/21). The Health Department is currently waiting for the hard copy of the "as built". Frado has approved the grading although the owner is not happy with the current state of the lawn but that is for the owner and Bonica to work out.

There was a discussion as to whether to send a notification letter to Bonica due to the delays and repeated failures to communicate with the Health Department. This culminated in Galligan moving to issue a warning letter to John Bonica for his performance on 60 Garnet Rock Road. The motion was seconded and passed unanimously. Bonica will have 10 days from the receipt of the letter to request a hearing with the BOH.

3. **Covid-19**

Massachusetts now has 29 cases of Covid B.1.1.7 (the UK Variant) of which 19 cases occurred in the last couple of weeks and there was also an instance of the South African Variant. Recent reports tend to indicate that B.1.1.7 is more harmful and more deadly. There was discussion about paying Zander and O'Connor as assistant dispensing coordinator and assistant clinic administrator and about reimbursement from the Cares Act. Galligan moved that the job description for assistant vaccine coordinator and assistant clinic coordinator (exact titles to be determined) be finalized for an amount not to exceed $10,000 to cover 2 positions for 13 weeks at $25/hour and 15hours/week, with the flexibility to move hours between the two positions. The positions would be approved by either the chair or the treasurer of the BOH. Approved unanimously.

There was a discussion as to whether Carlisle should allow registration to the general public (i.e., outside of Carlisle residents). Carlisle has not been given the requested vaccine for 2 weeks in a row and going public might help us acquire vaccine. It is possible that if we went public, we might be able to set up a wait list to ensure that Carlisle residents receive at least some of the vaccine. We might also go public to get the ball rolling and then go back to private. Fantasia suggested that she could send a letter to her contact in the State Health Department who might then forward it to the appropriate person to get the ball rolling.

4. **Goal Workshop**
   The goal workshop evidently came from a group attempting to realign the town land use departments. Given the current Covid crises as well as the BOH management of critical projects it was felt that the BOH is not currently able to work on goals.
5. **Budget Update**
   The BOH has not heard back from the Select Board about its budget request.
6. **Annual Report**
   Town meeting is not until June 5 so the BOH has not missed the deadline. There was a call for volunteers to write a narrative of what the BOH has done in the last calendar year—Galligan said she will follow up with Fantasia on this.
7. **Adjourned**
   The meeting adjourned at 20:37. The next meeting will be 3/9/21.

Respectfully submitted,

David Erickson,
Recorder

(All documents discussed are available for review in the office of the Board of Health)

BOARD OF HEALTH
Minutes
Tuesday, March 9, 2021
7:00 PM
Remote Participation
Join Zoom Meeting
https://us02web.zoom.us/j/83279854137
Meeting ID: 83279854137

7:00 Minutes 10/10/19, 2/16/21
7:30 Benfield Farms – status report from Meridian Engineering

Discussion Items

27 Old East Street – Accessory Apartment Appeal
Open Space & Recreation Draft – comments
COVID-19 report
FY22 Budget
Personnel Request
2020 Community Chest Grant Status Report

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Fantasia Health Agent, Kris Gines, Mark Beaudry (Meridian), Elizabeth Daglish, Maureen Deery (Carlisle Affordable Housing Trust), Dave Erickson, Phil Giffee (Benfield Farms), Mal Nelson (Benfield Farms),Lee Storrs, Bill Risso, Ginny Turner, 617-697-5600

The meeting was called to Order at 7:00 pm.

1. **Minutes**—the Minutes from 10/10/19 and 2/16/21 were approved with minor changes.

2. **COVID Update**
Trisha McGean was able to vaccinate 11 home bound residents with no adverse reactions. We owe a debt of gratitude to Concord for sharing vaccine with us.

A collaborative consisting of 8 towns, including Carlisle, is proposing a regional clinic to the state. The clinic would address a gap in the state's planned mass vaccination site locations. Two sites are being proposed: the former K-Mart in Acton and drive-up structures in the Concord Carlisle High School parking lot. The CCHS structures were used for the First Responder Clinics. There will be a meeting on Thursday to come up with a plan to be submitted. Since there are 8 towns involved there will need to be a traffic plan and also a plan for staffing. Staffing will include paid municipal staff and volunteers. A full day clinic requires 10-15 medical personnel and up to 15 non-medical. We would like the clinic to have evening hours as well as since many of the medical volunteers work during the day.

To be considered a clinic must be able to administer 750 to 1000 doses per day for a minimum of 5 days per week. Mariano noted that if this gets approved we will be talking about 1000s of doses/week. He asked about the doling it out to multiple locations so that possibly Bedford and Carlisle could have a clinic in Carlisle. Fantasia said the towns do not want to complicate anything at this point and noted that the State has made it very clear that they want a single mass vaccination site and not local community clinics. It was noted that Carlisle purchased the drive-thru structures largely at the State's request and we need to use the structure so we can get reimbursed. Fantasia thinks our drive through system is very efficient and it might be possible to set it up at the regional clinic. Galligan suggested it could also be used as a drive-thru clinic at the regional site; making use of it in some capacity will provide a better chance of getting reimbursement. Fantasia will post a vaccine advisory meeting on Monday.

Fantasia said that another swap meet is being planned and there was some discussion of traffic management, although it was felt that the last swap meet was well handled. The committee has improved many of the features based on their experience with the previous ones.

The COVID tally is up to 164 cases--they are largely family clusters but nothing like we were dealing with in November, December and January. The school has been responding quickly to reports of infection and is doing routine pool testing. The school held a meeting last week with the Board of Health to discuss loosening up occupancy guidelines on buses; the School Committee will consider a compromise between current practice and the new state recommendations at their next meeting.

The COVID discussion wrapped up with a formal vote to participate in the local consortium for a regional vaccination clinic. Acton has offered to be the lead team and will write up the plan, which is modeled on one submitted by the Town of Hopkinton.

Galligan moved that Carlisle join with the other towns in applying to the state for a regional vaccination clinic. Barry seconded the motion and it was approved unanimously.

3. **7:30 Benfield Farms status report**

Beaudry had forwarded to the Board an email from Sylvia Willard, Conservation Administrator, on a meeting with town counsel Tom Harrington, and Conservation Commission (CC) members Lee Tatistcheff (Chair) and Alex Parra. Counsel had been asked to review the legal documents relative to the Benfield Farms Conservation Restriction and Easements.

Harrington advised the following:

1. The septic field does not need to be constrained to the easement since the easement was a local initiative and can be amended.
2. CC, BOH, and Select Board should work together to find the best area for the system.
3. The proposed work will not require a change to the Conservation Restriction so there is no need to go to the state.
4. The CC will expect that when the work is done the septic field will look like a meadow, not a mounded field.
5. If further access is needed to Tom Harrington then the BOH should go through the Select Board.

The question of putting the system on Lot 3 had been raised earlier since it is not part of the Conservation Restriction but held by the Recreation Commission. Beaudry said the land is heavily forested and according to older soil tests has a high water table and less favorable percolation rates (12-18 mpi compared to 5 mpi on Lot 4). Beaudry was not able to get an exact estimate for locating a system on Lot 3 but indicated that with the land clearing it might be $75,000-$100,000 above the cost of the system on Lot 4 estimated to be around $120,000. Beaudry felt this was impractical.

Beaudry would like to have the location decided so he can move forward with the design. His proposed design would include a 4.0’ separation to groundwater using the .9’ groundwater mounding calculation of the original septic design. This would put the mound approximately 10” above existing grade. It would be possible to fit it within the contours of the proposed location to make it acceptable to the Conservation Commission. The Board noted that a recent study conducted by Onsite Engineering referred to a 2.6’ groundwater mounding offset. Beaudry said this would put the finished grade 3.5’ above ground and make it very hard to blend in with the natural setting. Beaudry suggested the Board be flexible on this issue since the effluent will have received pre-treatment. He noted that the metered flows averaged 1000 GPD or approximately 25% of the Title 5 Design flows of 3900 GPD. In response to a question from the Board, Beaudry explained that 10-12 soil tests were done with at least 6 test pits within the proposed footprint. Beaudry was confident that the soils were well defined. He is considering using a GeoMat alternative technology which would lower the height of the mound.

Beaudry says the treatment component is not yet designed but he would like to begin work on the disposal field, possibly facilitated by having two disposal permits (one for the field and one for the treatment system). Access to the leaching area via a cart path can be problematic during wet weather and will require an Order of Conditions. Beaudry would like to start work on the field before the wet summer weather. A second permit would be obtained for the treatment unit design.

There was considerable discussion of this request and the history of the system.

The board discussion, with former board members Risso and Storrs, included the following:

- Testing and experience indicate that the soils in the former field still have red flags and the potential for problems in the substrate layer. This may be true of the new location which is adjacent.
- Any design needs to provide high assurance of protecting public health; use of metered flows is not practical since there is no way of predicting future uses.
- While Beaudry must balance acceptability to CC, the BOH purview is public health. The CC function is complementary, and their terms may include appearance and issues related to use of the land.
- Construction should not begin on part of the system until both the pre-treatment and disposal field have been designed and the integration considerations are set; two permits may be confusing although only a single Certificate of Compliance would be issued for the system.
- Questions were raised about the likely design of the field. Beaudry reported that the preliminary design used a PercRite system (same as original system) because other alternatives would require more fill. He is proposing a GeoMat system which will require upgrading the pump chambers.
- As far as digging out the existing leaching field and using Title 5 sand, Beaudry reported that test pits revealed impermeable soil to ~7' depth so this would not be an option.
- Like the current system, a "canary well" will be present.
- Flow rates should not be reduced; a larger, more robust system is the better approach.
- Historically, solids were pumped into the field. The PercRite system is sensitive to solids and clogging, which raised concerns about potential failure. The pre-treatment is critical because plugging up the PercRite can push liquid through a few spots, which will bubble up to the surface. If a drip system is used, a filter should be incorporated prior to the drip system with an alarm that is set off when the flow slows down or stops.
- The whole design should be presented to the board, along with consideration of pre-treatment potential problems and how they would affect the system.
- Access to the field is limited to a small window of time so timely design and approval are critical.

Beaudry is meeting with CC two days hence and will provide a preliminary design at the next BOH meeting. The Board agreed on the following:

- The Board will not entertain any waiver requests,
- System must be designed according to Title 5 Minimum Flow Rates and not actual metered flows
- A decision must be made on what systems are being proposed for leaching field and pre-treatment
- It would be helpful to demonstrate what a conventional Title 5 system would look like
- Preliminary plans for the leaching area should be submitted so that Rob Frado has time to review before the next meeting. This will not be a full technical review but an assessment of the assumptions of the design. The plans do not need to include full construction details.

It was noted that Title 5 systems >2000 gpd require an independent review of ground water mounding, which will be arranged. The Board reiterated that its decisions will be based on protecting the public health and the environment. Conservation and esthetic features must be secondary. The Board is willing to consider CC's input but is obligated to follow Title 5.

4. Other business

No additional information on FY22 budget or personnel.

2020 Concord Carlisle Community Chest (CCCC) grant -- Fantasia and Galligan met virtually with Executive Director Jennifer Ubaldino. CCCC recognized the difficulty in using grant funds during 2020 and is willing to extend the completion date to the end of 2021. One of CCCC's interests is the mental health impacts of COVID, especially on children, and we discussed outreach on mental health as a grant deliverable. Following the CCCC meeting, Fantasia met with colleagues from nearby towns and the group will share costs and sponsor a series of workshops for parents and children.

27 Old East Street and Open Space are postponed to the next meeting.

The next meeting is set for 3/23/21.
Galligan moved to adjourn, Barry seconded and the motion was approved.
Meeting adjourned at 21:04.

Respectfully submitted,

David Erickson,
Recorder

(All documents discussed during this meeting are available for review upon request in the office of the Board of Health)

BOARD OF HEALTH
MEETING MINUTES
MARCH 23, 2021 7:00 PM
REMOTE PARTICIPATION

Agenda

Remote Participation by Zoom Meeting
Tuesday, March 23, 2021 at 7 pm
Meeting ID: 832 1092 7189 https://us02web.zoom.us/j/83210927189

7:00	Minutes
7:10-7:30	95 Hanover Road – septic system installation (Nouvellon)
7:30-8:15	Benfield Farms – septic system upgrade
	7:30-7:45 Plan presentation
	7:45-8:15 Board discussion, Q&A
8:15-8:30	27 Old East Street – Accessory Apartment – septic upgrade status
8:30-8:40	Open Space and Recreation Plan – Board comments
8:40-9:00	Other Discussion Items and New Business

- COVID-19 Updates
- Carlisle Public School RTN 3-35688 report from Omni Environmental
- Garrison Place – status of Septic Escrow Account, Operations Manual, Sampling Results
- Public Health Excellence Grant Opportunity
- FY22 Budget Update
- Municipal Vulnerability Grant – March 27th Workshop

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Fantasia Health Agent, Kris Gines, Mark Beaudry (Meridian), Rob Frado, Chantal Nouvellon, Justin Daglish, Dave Erickson, Bill Risso, Michael Joseph, David Schofield, Terry Holsinger, Ted Doucette, Derek Zanga, Emily Smith (Carlisle Mosquito)

The meeting was called to Order at 7:00 pm.

1. **Minutes**—the Minutes from 3/9/21 will be reviewed at the next meeting. Fantasia will incorporate edits and send them out for review before the next meeting.

2. **95 Hanover Road - septic system installation (Nouvellon)**

This has been an ongoing project which seems to have been complicated by Nouvellon's installer's license having lapsed and by the installer not properly communicating with the town. The well was drilled in 2012 and a water test done on August 20, 2020 was submitted last week. The water test must be performed within 12 months of occupancy. The well cap was fractured at one point and needs to be verified. The BOH agreed that the Well Inspector will do a current inspection on the well.

Nouvellon would like a temporary occupancy permit, which the BOH cannot grant because there is no septic system. The next steps for the septic:

- A licensed contractor must sign out the plans. The homeowner could get a licensed installer, or her previous installer could renew his license.
- A detailed workplan and schedule must be provided by the installer, including details on how the fill will be removed and the inspections.
- Frado needs to verify that the stakes for the septic field are properly placed. The engineer will stake the corners, as the first step, and provide the offsets. No work may proceed until Frado has approved the bed. David Schofield, engineer, confirmed that this will be done.

Mariano expects that a licensed installer should be in place within a week. It should then take 2 weeks to submit a work plan. The current fill must be removed and Frado may need to observe part of the removal which will be charged to Nouvellon. The Board instructed that communication with the Health Department should be handled by the engineer and installer since they are more familiar with the required procedures and this line of communication will ensure that the installation is

completed in the most time effective manner. The BOH will send a letter with this timeline outlined as well as details on getting the water certificate. The following schedule was outlined for Nouvellon:

- Timeline:
  - By Thursday, April 8 - Licensed installer on board and plan signed out.
  - By Thursday, April 22 – Installer provides work plan to Health Department.
    - After approval of work plan, commence replacing the fill and completing the field.
    - Health Department schedules Frado for inspections
    - 4 weeks for inspections & as-builts
  - Thursday, May 20 – certificate of completion, per this schedule

3. **7:48 Benfield Farms septic system upgrade. Present Phil Giffee (NOAH) and Mark Beaudry (Meridian Engineering).**

Beaudry reviewed the results of the stakeholders meeting (ConsCom and Town Council) reiterating that fill on lot 4 was permissible provided that the finish grade looked natural and that working outside the easement was acceptable. The design has been moving forward with that understanding and Beaudry has since forwarded the following summary of the plans:

Perc-Rite

As presented at the BOH meeting last week, the design has been evolved to allow the reconstructed system footprint and grading to be located outside of the existing Utility Easement consistent with ConCom and "stakeholders" direction. Secondly, based on BOH desires to have no waivers, we are providing a system design with a 4-foot separation to the previously approved 0.9-foot groundwater mound (calculated to be at full design load). A scenario with a 3' separation is also depicted on the plan, but we do not anticipate going this route as it would require Local Upgrade Approval relief.

With the layout adjustment, the finished grade at the corners of the system would all be 0.6 feet (about 7 inches) above existing grade. We believe this can be mitigated, that is, blended into the surrounding area and concealed, with the "off grading" of added fill around the edges to comply with ConCom and CCF requirements relative to the Conservation Restriction. Proposed grading is now depicted. The utility easement will be adjusted upon completion.

GeoMat

Also as presented at the BOH meeting last week, this design alternative was selected to provide what our team believes to be an improvement to the disposal area with enhanced, longer term performance (and "peace of mind"), more complete and uniform distribution, and enhanced treatment prior to recharge as a bonus. This leaching bed layout involves placement of a 6-inch-thick sand bed in the required bed footprint area (as sized for new construction at an LTAR of 0.74 GPD/SF). On top of this sand bed, rows of 24" wide GeoMat Leaching System will be installed. GeoMat is a product developed by Geomatrix Systems LLC that is approved as an alternate system for General Use and Remedial Use by the MassDEP. It is a low-profile system consisting of an approximately 1" thick highly transmissive core (comprised of fused entangled plastic filaments) fully wrapped in a hygroscopic membrane. Perforated distribution pipe laterals are then placed inside each of the membrane "units" on a plastic seat/shield on top of the core. The laterals are then loaded uniformly by traditional pressure distribution techniques. This will require a new pump chamber to be located adjacent to the disposal area. It is intended that this new pump chamber will be supplied by the existing "Perc-Rite" pumps (in the pump chamber near the Benfield housing) and the 2" force main down the cart path that will be retained. The GeoMat system with lateral is only 2" to 3" tall and requires only 6 inches of cover. Therefore, the finished grade with this system can be lower than the Perc-Rite system with a fill of only 4" to 5" above existing grade while maintaining a 4' separation to the mounded groundwater (at 0.9' maximum mound). Proposed grading is depicted.

This system will also require components to be located outside of the existing Utility Easement and will the utility easement to be adjusted upon completion.

Treatment System

A letter outlining the proposed upgrades to the treatment system, which is anticipated to be an added MicroFAST 0.9-unit, recirculation system and Micro-C supply modifications, will be forwarded to the BOH shortly. This treatment approach was discussed with the BOH at its meeting last week.

4. **27 Old East Street – Accessory Apartment – septic upgrade status. Present: Terry Holsinger (owner), Ted Doucette (engineer)**

Fantasia noted that the accessory apartment, which was not approved by the Planning Board, is in a detached garage and there was no documentation on how the apartment is tied into the septic system. It has since been verified that it is properly tied in. The BOH has set timelines for the permit (Jan. 1, 2021) and completion (May 1, 2021). It will not be possible to meet the May 1 deadline. Since it is not a failed system it seems appropriate to grant an extension. The following schedule

was outlined: testing next week then 2-3 weeks to get the plan and then 1-2 weeks to review the plan looking for July 30 for the "as built" plan and the certificate of compliance. The BOH will send out a letter that can then be used as a basis for communication. The Planning Board will be copied on the letter.

5. **Open Space and Recreation Plan – Board comments**
Open space plan needs final comments by 4/30. Mariano and Fantasia have discussed it. Galligan focused on the highlighted areas when reviewing it but Mariano looked through the whole plan and said it was an enjoyable read but just looking at highlighted areas is probably fine. It was noted that the term "shared septic system" was used incorrectly and was flagged. Thorsen noted that there was a lot on water, barns, and beavers but not so much on people. Fantasia noted that we do not want to confuse this with the Master plan--this is the open space and recreation plan. Barry noted that a 400 page plan every ten years is a lot of work, but Fantasia said that it is needed to apply for grants and that every town goes through this. Mariano noted that it is really important to the town; we will revisit some of those initiatives and get comments out.

6. **Covid Updates**
There were 168 cases as of 3/21/21. Every week we get a few more cases but not like last year. The application for a regional clinic at the Acton Kmart was submitted on Friday; we have not heard anything yet. Fantasia thinks it is a good plan at a good location, but we will not have any vaccine earlier than mid-May at which time we would hire a professional staff. We are also talking with UMass Grad School of Medicine about sending students to do vaccinations. No one has any idea how long this will go on, especially if there is a vaccine for children. There was some discussion about allocation of vaccine between states with the perception that people are resisting vaccination in Southern states which may be why some of them are opening vaccination to younger people sooner than other states. It was decided that there was nothing pressing for the vaccination subcommittee so it will not schedule a meeting until we hear back from the state. Fantasia has followed up with contact Jana Ferguson on a budget matter but otherwise has no additional information.

7. **Other business**
The environmental consultant for the school elevator spill is filing for closure to the project and recommending an end to the carbon filtration system which would be good because it was interfering with radon issues.

Fantasia notes that their new milestones for Garrison Place that will involve BOH approval. They are about ready to enter occupancy to unit 10 on June 16 but we want to insure they have satisfied BOH regulations, especially the septic escrow account. They are not currently asking for a certificate of compliance on the septic, they are moving ahead but nothing major now.

Public Health Excellence grant opportunity. Galligan said that Fantasia made us aware of a state grant that allowed a group of towns to apply for a grant for shared services. There are 351 local BOH departments and the state would like more cooperation to raise the level of performance and improve uniformity across the state. The state is making a large pool of funds available for groups who will work together so Fantasia has worked with 5 other towns to get funding to share inspectional services for pools, septic systems, and food establishments as well as other Health Department duties. It is a good opportunity and Sudbury is writing it up. Galligan is skeptical about our changes of being awarded the grant, as the state is looking at the nature of communities and especially underserved communities. The state has 30 grants for up to $300,000 per year and for 3 years.

FY22 Galligan says Fincomm met the other night. They are in support of 10 hours for a public health nurse but not for additional hours for our Assistant to the Health Agent. There is a meeting with the Selectboard tonight to see what both groups would support. While it is positive that they will likely approve 10 hours for a public health nurse it is frustrating that they do not recognize that need for additional AHA hours. More monitoring of compliance, especially in larger projects, might avert the sorts of crises we have been seeing. Despite limited hours Gines does an outstanding job and has been getting as much done as possible. It might be helpful if our Selectboard liaison participated in more BOH meetings.

Municipal Vulnerability workshop is Saturday, and they would like to have BOH representation. There will be presentations and break out groups.

Fantasia brought up that hazardous waste day has not been scheduled. There was talk about whether it should be opened to other communities, but the general feeling was that we should keep it restricted to Carlisle residents. Fantasia will book a day for Carlisle in the fall. Galligan suggested we also talk to the Selectmen about reopening oil collection. It was also suggested that the swap shed might be reopened (possibly limiting it to 2 people at a time). Barry says that the science indicates that fomite transmission of Covid is minimal (see https://www.nature.com/articles/d41586-021-00251-4 for one discussion).

Barry moved to adjourn, passed unanimously. Adjourned at 21:37

Respectfully submitted,

David Erickson, Recorder

(All documents discussed are available for review in the office of the Board of Health)

BOARD OF HEALTH
Minutes for Tuesday, April 20, 2021 7:00 PM
Remote Participation

7:00	Minutes
7:00-7:10	Minutes 3/9/21, 3/23/21
	Request for Deed Restriction. 137 Bingham Road (withdrawn)
7:10-7:20	67 Hanover Road. Request to reduce Perc-Rite sampling frequency.
7:20-7:30	Bonica Excavating Co. Installation Update (tentative)
7:30-7:40	Septic Upgrade Extensions
	▪ 27 Old East Street
	▪ 49 Concord Street
7:40-8:00	Garrison Place. Request for Certificate of Compliance
8:00-8:30	Benfield Farms. Septic System Upgrade

DISCUSSION ITEMS
COVID-19 Updates
FY22 Budget
Old Home Day Planning

Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Fantasia Health Agent, Mark Beaudry (Meridian), Elizabeth Daglish, Dave Erickson, Joey LaPointe, Robert Lilley, Steve Martini, Gerry Boucher, Phil Herman

The meeting was called to Order at 7:00 pm.

1. **Minutes**—the 3/9/21 were reviewed and several minor edits were suggested. Barry moved to accept the minutes as corrected, Margolies seconded the motion which was approved unanimously. The 3/23/21 minutes were tabled to allow more time for review.

2. **137 Bingham Road withdrew their request for a deed restriction.**

3. **67 Hanover Road. Request to reduce Perc-Rite sampling frequency.**
The Perc-Rite system had failed so the sampling frequency had been increased. Since 2016 the system has been operated by Eco-Dynamics and they have been complying, so they now want to return to the regular yearly testing schedule. Galligan moved to allow 67 Hanover Rd. to go from quarterly sampling to yearly. Barry seconded the motion, and it was approved unanimously.

4. **Miscellaneous**
Fantasia has issued licenses to Kimbals and Great Brook Farms to open their ice cream stands. She is still working on annual report. There will not be a caucus this year--instead of a caucus anyone running for board seats must pick up papers and with only 10 signatures required to run there could be a lot of candidates. Continuing members will also need to take out nomination papers, Fantasia does not yet have the relevant dates.

5. **Covid**
Standards for close contact on the bus or in the classroom has been reduced to 3' (from 6'), schools can opt to stay with 6'. The State is looking at new distance requirements in the event of new cases. All teachers who wish to be vaccinated have been vaccinated.

Vaccination statistics are available on the dashboard--they are updated every Thursday. Carlisle cases are on the increase with 202 cases as of last week. New cases seem to be the result of family transmission and they are

climbing because of the new variants. Barry says B117 seems to be the predominant variant. It is much easier to catch as it is about twice as contagious as the strains circulating a year ago. Given this, the need to wear masks was stressed, there was puzzlement expressed that the state is not more forceful in promoting the use of masks.

Fantasia would love to get vaccine, use our structure, and prepare for boosters in the fall. Thorsen said Moderna is planning a combination flu and Covid vaccine and may file for emergency approval next week. Barry is concerned that these companies are motivated by money, she thinks people may be protected for at least a year. Antibody levels do not tell the entire story, we need to see if people actually contract disease.

6. **Bonica installation update**

Bonica is not present. Mariano said there have been some missed deadlines and work being done outside specified dates. Fantasia has been in touch with Bonica, and we were hoping he would be here tonight. Fantasia has been in touch with him, and he said that it was a combination of personal and weather issues--he had to plow the bed four times and agrees that winter installations are very difficult. He wanted to remind board that he has been licensed in Carlisle for many years and has never had any problems and has a good relationship with Frado. Mariano was inclined to back off issuing a warning letter. Barry agreed with Mariano although she was disappointed that he was not present and asked whether Fantasia's conversation provided evidence of mitigating circumstances. Galligan did not think we should put Fantasia in the position of advocating for Bonica—the BOH made it very clear they did not want to allow a late start and then when it went off plan, Fantasia was repeatedly chasing him. Galligan felt he should have been communicating with us and felt the BOH should at least issue a warning. After more discussion **Galligan moved to send a letter of warning to John Bonica, Margolies seconded the motions, and it was approved unanimously**. Fantasia will handle sending him the letter.

7. **27 Old East Street Septic Extension**

High water has delayed the perc tests so the schedule needs to be updated, they may have to wait until June instead of March 31. They are proceeding and Fantasia received word from the owner that their apartment tenant will be moving out. The system is not in failure, but they cannot use the accessory apartment until the BOH approves an upgraded system. Galligan, suggest we defer this--a dry spring may allow testing sooner and while Galligan agrees with an extension she would rather wait to see how conditions develop. Mariano agreed and it was decided to defer discussion of an extension.

8. **45 Concord Street Septic Extension**

The BOH has granted several waivers but now there is an unfortunate change of plans because of a death in the family. They are not going to build the garage so the question of opening discussions to remove some of the waivers came up. Fantasia did invite the owners to this meeting, but she was not sure they understood what is at stake. After some continuing discussion Mariano thought the BOH should table this. Galligan thought it might be better to have a conversation offline and Fantasia will set something up.

9. **Garrison Place request for certificate of Compliance**

Fantasia said the septic is functioning and that an occupancy permit was issued 2 weeks ago. The BOH wants compliance for Perc-rite and Fast system. The septic escrow has been funded and they put together a spread sheet for sampling, but the units have only recently been occupied. Joey LaPointe is the project manager and said that the system has been in operation for a couple of years--he believes that they have met all the obligations for a certificate of compliance. Galligan noted that there have been samples where total nitrogen is out as well as BOD. There was discussion of sampling. It was eventually decided that the BOH needs to see the data and after Mariano goes over the data with LaPointe and Fantasia the BOH will revisit this issue.

10. **Sampling Wells**

Mariano brought up that the BOH is seeing problems with septic monitoring wells not being useful. During part of the year, they cannot be sampled because they are dry. The BOH should discuss sampling wells, possibly including engineers. He asked Fantasia to put it on a future agenda.

11. Benfield Farms septic upgrade

Beaudry said that Benfield Farms representative was not able to attend, he will provide an update tomorrow. The Geomat system had looked like a good system but further engineering works this afternoon showed that Geomat would double the footprint of the system, so it has proved to be untenable. Consequently, they are going back to Plan 1 for the Perc-rite system which makes the infrastructure simpler, and they can keep the current pumping station and force line, merely relocating the system over to the new area. Beaudry forwarded Fantasia a letter from Biomicrobic (producers of the MicroFast system). They are proposing the MicroFast 0.9 system which should take care of residual carbon from the MicroC system. They will also put in a dedicated pipe for the MicroC instead of tanks for better all-weather delivery and to require less manual intervention. It turned out that under previous management that the MicroC pump had failed so there was a period of no MicroC. The new management company, Waste Management discovered it immediately. The new system will be basically the same system but easier to monitor. Mariano is concerned that there should be less need for manual involvement. If companies are monitoring the process, there is always the possibility of not fully transferring protocols to new operators. Beaudry notes that conservation approval is important--over the last weeks they have confirmed wet land lines and will be moving forward with concsomm to get approval for access to construct system.

Beaudry presented preliminary designs at the last board meeting. ConsCom is happy with what they have seen since the last BOH meeting. Beaudry will be working with ConsCom concurrently with furthering the design. Beaudry would like to avoid waiting until august. They can use swamp mats to allow access when the cart path is wet--the path was not dry until August last year. Galligan said that the system failed 2 years ago on May 6 and there is a 2-year replacement period. Fantasia said the board can extend the period if they have an enforceable agreement. Beaudry should keep in mind that the system has been shut down and is going to a tight tank. Galligan asked whether this should go back to a conventional system and wants to avoid rushing at this stage. Mariano asked Galligan to elaborate on "conventional system" and noted there are major issues with conscomm. Galligan said a sand filter and a conventional field would be a conventional system. BOH concern is protecting public health and the environment. There was considerable discussion of conventional vs. Plan 1 design and difficulties that might result with ConsCom. It was finally agreed that Beaudry would look at conventional designs and that there would be a special meeting next week to go over the enforceable agreement.

12. FY22 budget

Galligan and Fantasia sat in on the Fincomm meeting--they were not going to revisit BOH request at the meeting so it looks like they will approve 10hours/week for public health nursing but not are unwilling to provide for more time by the administrative assistant. There was also some discussion of the new review process and questions about when decision will be made about things like employee health insurance co pay.

13. Other

Old home day is being planned but largely depends upon state regulation—maybe could occur in the fall.
Fantasia will schedule a toxic waste day in the fall.
Thorsen and Margolies are not running for another term.

Galligan moved to adjourn, seconded and the motion was approved.
Meeting adjourned at 20:52.

Respectfully submitted,

David Erickson, Recorder

(All documents discussed are available for review in the office of the Board of Health)

BOARD OF HEALTH
MEETING MINUTES
Tuesday, May 11, 2021
7:00 PM
Remote Participation

7:00 Minutes
7:15 Old Home Day Planning (Niles Cocanour)
7:30 Reciprocal Hazardous Waste Agreement (Barny Arnold)
7:45 Summer Fun Program (Holly Mansfield)
8:00 Benfield Farms
. Peer Review Consultant Selection
. Research report from Meridian Engineering
Discussion Items
COVID-19 status report
Public Health Excellence Grant
Town Caucus
The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

The meeting was called to Order via remote participation at 7:00 pm.
Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan, Donna Margolies, Todd Thorsen
Attendance nonmembers: Fantasia Health Agent, Mark Beaudry (Meridian), Dave Erickson, Niles Cocanour, Christie Cocanour, Phil Giffee, Holly Mansfield, Barney Arnold, Launa Zimmaro, Mal Nelson, Rob Frado, Mike Moreau, Carlos Quintal, Ginny Turner

1. **Minutes**
   Minutes are postponed to the next meeting.
2. **Old Home Day Planning (Niles Cocanour)**
   The committee started meeting several months ago, at the time there were 2 dates proposed 6/26 and 9/25 and 6/26 was finally selected. There will be a number of changes this year as a result of Covid. There will be a staggered start for the road races, cakes will be displayed at the school (FRS will be closed) with one way and limited traffic for the viewing, the pet show will be virtual (which will also be easier on the pets). Mask wear will be encouraged outside and required inside. It is undecided whether there will be food trucks--if there are people must take their food and sit to eat it. There will be games, some games, like the egg toss, lend themselves to social distancing. If there is a town fair it will be in the school parking lot. The committee will watch the swap meet for ideas on the town fair and will keep the BOH apprised of their plans.
3. **Reciprocal Hazardous Waste Agreement**
   Barney Arnold is the liaison to the Energy Task Force, and she reached out to Julie Green, the regional coordinator for The Mass CEP (Comprehensive Energy Plan) about recycling hazardous waste. The concept of the "Massachusetts Reciprocal Arrangement for Hazardous Waste Disposal" was before the board a while ago. This arrangement would mean residents of other towns could participate in Carlisle Hazardous Waste Day and Carlisle residents participate in hazardous waste collection in other towns. Green says that in her experience the number of non residents that show up is usually very small; on May 1, Dracut had 100 cars of which 5 were non residents, which is typical of a small town. Non residents would need to pay and there was concern about collecting the payments of non residents. Collaborating with other towns could give us points with the state that could provide some value to Carlisle. It was decided to continue this discussion at the next meeting, in the meantime, Arnold explained, Green has allowed us to tentatively put our name on a list, but Carlisle residents cannot go to other towns unless we execute the Reciprocal Agreement.
4. **Summer Fun Program (Holly Mansfield)**

Holly Mansfield has sent the Summer Fun Program description (June 20 to Aug 6) to the BOH. There will not be an extended day program. The participants will be in pods with 4 groups of 10 for a maximum of 40 participants. Kids will stay within their pods for the day with no intermingling. They are still considering whether they should keep siblings together and they are unsure whether kids will need to wear masks at activities. They will be following good hand washing routines, cleaning bathrooms and porta potties twice a day which will be available only for fun day kids. Last year they did pre-screening; they had parents fill out a form every day and it went smoothly. Mansfield wanted to know if that would be necessary this year. After doing screening questions the child would leave the car with the parents staying in the car. If any household tests positive, then their child could not come and if anyone in a pod tests positive then the pod will be barred from continuing the program until everyone is cleared. Mariano thought that outdoor masks are not required but Fantasia said that the governor has not yet changed the mask mandate. Fantasia said that they had no cases last year, but that prescreening will still be required, pods can go to 25 and siblings do not need to be together. Mansfield said they have a wait list so they could increase the pod size, but they wouldn't want to go over 12.

5. **Peer Review Consultant Selection**

Fantasia: three peer review quotes came in with one coming in lower. Mariano, Galligan, and Barry seemed to prefer Peter Shanahan of Hydro Analysis. Shanahan worked on the Woodward Village project.

6. **Research report from Meridian Engineering**

Beaudry said that the board had asked him to investigate alternatives to the proposed system. He has looked at the Presby Environmental disposal system, but the primary purpose tonight is to talk about pretreatment since disposal was largely covered last time. Beaudry asked Mike Moreau to attend to talk about the existing FAST system and Carlos Quintal who is familiar with other types of systems. Quintal has been designing waste treatment systems since 1980 and with about 40 treatment plants throughout Massachusetts has a good understanding of how they work. He said that for a treatment plant, 20ppm of nitrogen (N) is the permit number. A recirculating sand filter will give you that a number but there are other alternatives. Regardless of the system, some type of fixed film bacterial growth is required to obtain the correct nitrogen discharge. In the Fast system, there is one tank with the bacterial film and the introduction of oxygen supports aerobic digestion, but the biological oxygen demand (BOD) needs to be controlled. Orenco, sand filters, Bioclere (AquaPoint) are other alternatives, but they all need careful monitoring at least during start up. They are all capable of doing 20ppm but they must be optimized, ideally you would look at alkalinity and BOD on a daily basis. Quintal would recommend minimizing the addition of carbon (Micro C) in the beginning until the system adjusts. Adding carbon can easily send BOD sky high. Quintal wouldn't advise something brand new at this stage for Benfield, it could be just as bad as what we have currently. Galligan asked whether a sand filter would be an option. Quintal didn't think a sand filter provided adequate flexibility; he has one in Wrentham that is not working well but you can't see it--the bacterial mat is not allowing filtration, but you can't tell from the top. Frado asked what the first step would be, and Quintal said the when the leaching area is functional go through the MicroFast, turn on the air, and see what comes out. He would like to see 4 to 5 times daily flow or higher recycled. You won't get denitrification until you get rid of the oxygen but by recycling you use a carbon source that is already part of the system, ideally it would work without the Micro C. It has been done but it's not easy.

Mike Moreau said Waste Treatment Systems (WTS) has been involved from the beginning; they changed from monthly to quarterly monitoring as time went on. He agrees that this is a water chemistry issue--with any onsite technology you don't have all the controls that you would have in a larger plant. Benfield is limited because it does not have a lot of food waste or soap but there is also a lot of variation in both BOD and Nitrogen which is somewhat unusual. Recirculation can help smooth out the variability and Quintal thinks that we should monitor as closely as possible, ideally at least testing alkalinity daily. Once the system is optimized testing could be scaled back. Quintal will be available to Beaudry as a consultant. Mariano thanked Quintal and Moreau and said he thinks the alternatives would not be an improvement at this time.

Beaudry then describe the Presby system. It consists of a 12" perforated tube wrapped in a material with a geotextile around it. Bedding area can slope with the slope and the tubes can be laid as close as 1.5' on center but

each section handles 500gal/day, so it requires 8 sections to get over 3900gal/day. It does not require pressure dosing and so does not require another pump station; the existing effluent pump can go to an 8 outlet D box. Each section is independent, and you need a foot of sand all around so the footprint would be 48'*87'. It is 28" from the bottom of the sand to finish grade so assuming a .9' mound and 4' ground water separation you end up with 1.9' of fill on the low side going to 2.4-2.5' fill on high side. The ground water separation could go down to 2' (with a perc rate of 2min/"). It's a great system and provides additional nitrogen removal--although MA doesn't give credit for that. We could safely go with some reduced ground water separation and still get appropriate ground water quality. A new compliance well will be installed. It would cost more than the perc-rite system, but the Board may feel more comfortable with this going forward--especially since it doesn't require another pump station with a 2-3hp pump in the field.

Mariano asked when Beaudry will be presenting to ConsCom on the wetland crossing, Beaudry said the next ConsCom meeting is May 27, but he hopes to submit the design by next week. Frado asked whether it will you show 2' or 4' separation--Beaudry will probably show something in the middle—he is not looking for full relief to 2' ground water separation but would probably be looking for about a 3' separation--he thinks it would satisfy the BOH and ConsCom which manages the land under a conservation restriction. Galligan said that Beaudry should not assume that he can use the middle ground option which requires a waiver approval from the Board. Beaudry said he will submit a preliminary design and the board can comment.

Beaudry has not submitted to ConsCom yet because he is trying to get information from the installer about whether they can get around the boulder in the cart path. The installer has not yet been able to get out to examine the situation--but they are very supportive of the Presby system--they have installed hundreds of them.

Beaudry has also been talking to Steve Smith at Geo-Hydrocycle and he says dry monitoring wells are common because of ledge; Mariano would like to entertain the possibility of moving the well a bit to avoid it going dry.

7. **COVID-19 status report**

   There was only one new case in Carlisle in the last 2 weeks; the testing positivity rate is .5%. There is a lot of talk of Pfizer being available for 12-15 year olds but the only ones doing this now are doing it under FDA approval, the American Academy of Pediatrics has not yet approved it but that may happen soon. Barry said that Middlesex had 18 cases recently and Concord had a huge cluster which shut their school down for a couple of weeks. The Carlisle school has been doing pod testing without a positive result and the fire department has not had a positive result since April 27.

   Galligan asked Fantasia to read an encouraging article in the NY Times that there is less concern about getting Covid from out of door activity, there is a much reduced risk outdoors, even if you are just few feet apart. Pfizer and Moderna work well against the variants but some of the other vaccinations don't work as well. Fantasia reported that unfortunately a Carlisle resident has traveled to India where he caught Covid and died.

8. **Public Health Excellence Grant**

   Five towns including Carlisle were awarded $300,000. The money will be used to hire and share additional staff – public health nurse, health educator and sanitarian. There will be a meeting this week to work out details.

9. **Town Caucus**

   Town Caucus will be this Thursday. It is only necessary to attend if you are nominating someone, Galligan will attend as she is nominating someone in another group but as yet there are no candidates for the BOH; if anyone can find someone let Fantasia know. Thorsen asked if candidates need signatures and Galligan said no unless you skipped the nomination, in which case the number of signatures required has been reduced to 10.

10. **Miscellaneous**

    Fantasia and Galligan still have reservations about hazardous waste--that will be discussed at the next meeting.

Barry moved to adjourn; Thorsen seconded the motion which was approved unanimously. Meeting adjourned at 21:34, next meeting May 25, 2012.

Respectfully submitted,

David Erickson,

Recorder

BOARD OF HEALTH
Minutes for Wednesday, May 26, 2021 7:00 PM
Remote Participation

AGENDA

7:00 Minutes 3/23/21; 4/20/21; 4/27/21; 5/11/21
7:15 Reciprocal Hazardous Waste Agreement (Barney Arnold)
7:30 56 Bellows Hill Road – Accessory Apartment (Sabatini)
8:00 Birch Lane Septic Installations and Fees – request to modify (Brem)
Discussion Items
95 Hanover Road – status report
Benfield Farms – status report
COVID-19
• Local Data
• Town Hall Reopening
• Regional Clinic Update
• Local Clinic Discussion
Public Health Excellence Grant
Board of Health Vacancies
The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

The meeting was called to order via Remote Participation at 7:03 pm. Attendance members: Tony Mariano Chairman, Jean J Barry, Catherine Galligan. Attendance nonmembers: Fantasia Health Agent, Dave Erickson, Barney Arnold, Kim Sabatini

1. Minutes

Minutes for 1/19/21 were discussed and amended. Galligan moved to accept the amended minutes, Barry seconded, and they were approved unanimously. The remaining minutes are postponed to the next meeting.

2. Reciprocal Hazardous Waste Agreement (Barney Arnold)

The reciprocal agreement was discussed. The general feeling was that only a few Carlisle residents would benefit from it and that implementing it could well involve more effort than expected. Given the limited resources available to the BOH the consensus seemed to be against joining the reciprocal agreement. Galligan moved to not participate in the Reciprocal Hazardous Waste Agreement and Barry seconded the motion. Mariano asked whether we should add to the motion to communicate with Arnold to get the word out about alternatives. It was decided not to amend the motion which was then passed unanimously.

3. 56 Bellows Hill Road

This is a request for an accessory apartment in a barn. The barn has an accessory apartment on the first floor and rooms and bath, with no kitchen, on the second floor. There was discussion of what restrictions to put on the approval. Galligan moved that the approval be conditional on routine water quality testing annually at a drinking water tap, water meters for the main house and the out building (total of 2 meters), no irrigation system, pumping of the new 4 bed system every 2 years, and that the BOH would have the same final plans as planning board. Barry seconded the motion. There was additional discussion and Galligan amended the conditions to remove the restriction on irrigation. Barry seconds the amendment and the amended motion was approved unanimously

4. Birch Lane Septic Installations and Fees

At the request of the developer, Jeff Brem, the matter was tabled.

5. **95 Hanover Road – status report**95 Hanover Road has have been moving right along, Frado has verified the removal of all the fill. A partial as built is needed and the final grade inspection is expected to take place in the next week or so.

6. **Benfield Farms – status report**
Shanahan is doing the peer review mounding study; they submitted the electronic copy on May 17, but Frado needs a paper copy, which only came in on Monday (5/24/21). Frado will try to get as much done as possible but probably will not have a full review by June 6. The notice of intent has been filed with ConsCom.

7. **COVID-19 status report**
The working group met and there is no interest in a regional clinic, there really seems to be little need for a regional clinic as many of the clinics are not getting the use they expected. People are not looking for the vaccine as much; they are either refusing it or have already been vaccinated. We will write to the state and thank them for their approval but until things change don't see a need to set up a clinic. As of June 15, the state of emergency will be over. The Town Hall will go back to full time on June 1, as will the library. Each department will manage whether staff will be able to work remotely. Old Home Day does not have to do all the restrictions they were planning unless they choose to and now Recreation only needs to follow camp regulations.
Mariano asked about unvaccinated youth—he is concerned about opening up with an unvaccinated population. Barry said there is no good answer, but from her reading it seems that COVID will eventually become like other seasonal viruses we encounter. Over time they become less severe because of prior exposure. In younger age groups COVID is typically less severe, but this could change if new variants arise.

8. **Public Health Excellence Grant**
Nothing is worked out yet; the group needs to meet to see how it will be administered.

9. **Board of Health Vacancies**
There was some discussion of the coming vacancies. No one has been identified, although David Erickson of 237 Fiske Street will be running as a write in candidate.

10. **Adjourn**
Barry moved to adjourn, Galligan seconded it and it was approved unanimously, adjourned at 20:53. The next meetings will be June 8 and June 22.

Respectfully submitted,

David Erickson,
Recorder

BOARD OF HEALTH
Minutes for Tuesday, July 14, 2021, 7:00 PM
Remote Participation

7:00 Welcome New Board Members
- Dave Erickson
- Patrick Collins

Board Organization
Minutes 6/8/21

7:30 295 Hanover Road – Request for Deed Restriction for Addition

Discussion Items

Tick Borne Disease
- Prevention
- Tick Testing

FY22 Contracts
- Engineering
- Emerson Home Care

Public Health Excellence Grant
Benfield Farms – Status Report

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean J Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Linda Fantasia Health Agent, Kris Gines Asst. Health Agent.

New Board Members

Patrick Collins and David Erickson were welcomed to the board. Board members then spent a few minutes introducing themselves with several members having extensive experience with many of the issues that come before the board.

Board Organization

Mariano was willing to remain Chairman and Galligan was willing to remain treasurer, although she does not plan on seeking another term on the board next year. David Erickson was nominated to serve as vice-Chairman; Collins moved to continue with Mariano as Chairman and Galligan as treasurer, the motion was amended to include Erickson as vice-chairman—the motion was then approved unanimously.

Minutes

Minutes from 11/04/2019 were tabled; the minutes from 5/26/21 were approved with Galligan's edits and changes to be made by Fantasia; other minutes were tabled for future meetings.

295 Hanover Road

The applicant has withdrawn their request for a deed restriction.

Tick Borne Diseases

Fantasia reported that a resident contracted Powassan virus disease and reached out to notify the BOH. While the Carlisle BOH should have been notified through MAVEN, that did not happen. Linda notified Dr. Catherine Brown, MDPH State Epidemiologist of the system failure and Dr. Brown is working on a resolution. Powassan is usually considered a rare disease, with 39 cases reported in Massachusetts from 2013-2020, however, it is not clear whether it is truly rare or just rarely reported as many cases may be asymptomatic or mild. The resident reported that he

removed an attached tick in March and was treated with doxycycline. When symptoms continued, it took Massachusetts General over 4 weeks to diagnose the disease and in the meantime the resident developed encephalitis. Prevention recommendations are the same as for all other tick diseases. Mariano thought next steps such as outreach and education would be better handled by the Lyme subcommittee. Fantasia will get in touch with the resident to see if he is interested in being interviewed for the Mosquito. Barry will do some research to give the Mosquito important facts.

Fantasia brought up whether Carlisle should subsidize the testing of ticks and Galligan moved that we allocate $750 from the Community Chest grant to subsidize $25 (of the $50 cost) for testing ticks. The motion passed unanimously.

Engineering and Nursing Contracts

Galligan moved to accept Frado's proposal for a 3-year contract at a rate of $135/hour (versus the current rated of $125/hour). This works out to about a 2.6%/year increase and seems in line with current engineering rates. The new contract was approved unanimously.

There was more discussion on the Emerson Home Care contract, with Public Health Nursing (PHN) follow up on cases reported in MAVEN increasing from $50/hour to $90/hour (an 80% increase). It was explained that the cost of Covid-related support had been significantly underestimated last year. In any case, the contract only applies when Carlisle chooses to use Emerson Home Care, so Galligan moved to accept the contract, Barry seconded, and the motion was approved unanimously.

Benfield Farms status

Mariano summarized the Benfield septic problems to bring Collins up to speed. Collins indicated that since he is a neighbor of Benfield Farms that he will recuse himself from any decisions. Mariano doubts that they will have a plan by 7/28 since Frado will be on vacation for a week he has not yet received anything. They have incorporated Shanahan's concepts and are doing a new design; they would like Shanahan's help with the design, but Mariano thinks that is inappropriate. Frado has reported that he is concerned with the results of the testing he is he seeing. Fantasia asked if she should get in touch with Peter Shanahan and have him stand by to look at the new testing. Galligan said we must set up a new contract, but Fantasia says she will just extend his current contract. Fantasia said Shanahan was happy to hear that they were moving the system to the south.

PFAS

Fantasia reported that a number of residential water supplies in Carlisle tested over 20 ppt for PFAS. PFAS results at the town hall were 38ppt and the library results were over 90 ppt: a level considered an imminent health hazard. The Library has put plastic over all the faucets, the Congregational church also has high levels. We missed the deadline for the first-round state grants for mitigation but there is a second-round deadline in October--Fantasia will put this on the agenda for the next meeting.

Covid

Since April there have been 11 cases in Carlisle. One person was 49 and another 20 years old, but all other cases have been in the young (age 1, 9, etc.). There were 2 cases in one household.

Adjourn

Next meeting will be on 7/28 and Aug 11,2021. The next meeting will continue to be on zoom.

Barry moved to adjourn, Galligan seconded, and the meeting was adjourned at 9:29PM.

Respectfully submitted,

David Erickson,
Recorder

BOARD OF HEALTH
Minutes for Wednesday, August 25, 2021, 7:00 PM
Remote Participation

7:00 Minutes

7:15 PH continued 142 Russell Street – septic system upgrade requiring local waiver for setback to wetlands

Discussion Items

COVID 19

- Community status
- Testing and Vaccinations

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean J Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Fantasia Health Agent, Kris Gines, Rob Frado, David Model (Selectboard liaison), Paul Kirchner, Tricia McGean, Jessica Moschella

1. **Minutes 8/11/21**
   Galligan moved to accept the minutes of 8/11/21 as amended, Barry seconded, it was approved unanimously.

2. **142 Russell Street request for Waiver**
   Paul Kirchner from Stamski and McNary said that they had removed the cleanout and added an electrical sweep as Frado had suggested and Frado confirmed this. There was a lengthy discussion of the possibility of rotating the septic field to allow greater distance to the wetland, but it was noted that this would result in increased tree clearing as well as difficulty in ensuring a proper swale to manage runoff from the adjacent property. It was also noted that Title V requires 50' to wetland as opposed to the 100' Carlisle requires, although Galligan pointed out that Carlisle is more reliant on private wells than most towns. Fantasia noted that the BOH has approved waivers up to 20' and that this is also an advanced bio septic system.
   After the discussion, Collins moved to close the hearing, Barry seconded, and the motion was approved unanimously. Galligan then moved to approve a waiver to the wetland of 83' contingent upon the final "as built" grade showing spot grades along the swale to verify the swale was built as intended and also conditional on approval by Conscom. The motion was seconded and approved unanimously.

3. **Covid 19**
   Tricia McGean reported that since 7/1 Carlisle has had 7 cases with only 1 person currently in isolation. Of those 7 cases, 4 were fully vaccinated. Concord has had 73 cases with 37 fully vaccinated and Lincoln had 23 cases with 20 fully vaccinated. The good news is that most have minor symptoms and kids under 12 have cold like symptoms. There is one person who is 90 years old who is currently in the hospital, but he had other comorbidities.

Mariano reconvened the Covid task force Monday night

The state has now implemented a mask mandate for schools so any BOH recommendation relative to the school is moot, however, the Selectboard would still like the BOH to make recommendations for the town. There was a general feeling that a mask mandate for the town was appropriate, but it was recognized that people working in an office, without direct exposure to the public, might find it difficult to wear a mask at all times. There was also discussion of improving air exchanges and filtering in public buildings, possibly by using portable air filters and we would like more information on airflow in town buildings from Bill Rizzo. Eventually, Barry moved that we implement a mask mandate for the entire Town of Carlisle for face masks for indoor public spaces except for employees working at their desk who should wear a mask whenever possible and also that we revisit this mandate in early October. Erickson seconded the motion which was then approved unanimously.

The BOH then discussed doing a pop up Covid clinic around September 25 but it was decided that given the current high vaccination rate in Carlisle that there was little benefit in holding such a clinic.

4. Miscellaneous

The Benfield plans were delivered to Frado's home on Sunday. The working group will continue working on the conditions and Frado will review the plans. There will be a special BOH meeting on 9/7/21 to review the plans and conditions. Hopefully, the BOH could have a vote around Sept. 14. David Model asked Fantasia to send a summary to the housing trust and Mariano notes that we need to amend the agreement.

5. Adjourn

There will be a Special meeting September 7, 2021, and a regular meeting September 8.
Galligan moved to adjourn, Collins seconded, it was approved unanimously, and the meeting adjourned at 21:37

Respectfully submitted,

David Erickson,
Recorder

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

BOARD OF HEALTH
Meeting Agenda
Wednesday September 22, 2021
7:00 PM
REMOTE PARTICIPATION

CANCELLED

Join Zoom Meeting
https://us02web.zoom.us/j/86136555525

Meeting ID: 861 3655 5525
One tap mobile
+13017158592,,86136555525# US (Washington DC)
+13126266799,,86136555525# US (Chicago)

7:00 Minutes

Discussion Items

COVID-19 Status Report
Benfield Farms – Septic System Upgrade

New Business

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates
Upcoming:

BOARD OF HEALTH
Minutes for Wednesday, October 6, 2021, 7:00 PM
Remote Participation

7:00	Minutes
7:15	75 Peter Hans Road (O'Brien) – request to modify existing Deed Restriction to accommodate new addition
7:30	288 Lowell Street (Guecia) – Deed Restriction request to add rooms

DISSCUSSION ITEMS

COVID-19 –
- Status Report
- Mask Mandate

Glass Recycling Proposition
Fern's Country Store – Water Issue Update

8:00	Benfield Farms Septic Upgrade (To be Rescheduled)
8:05	Garrison Place – discussion of Permit Conditions

New Business
The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean J Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Fantasia Health Agent, Rob Frado, David Model (Selectboard liaison), Wanda Avril (Carlisle Mosquito), Mark Beaudry (Meridian Systems), Jack Huntress, Carrie Patel, 978-254-5943, Ken Ayres, Gerry Boucher, Phil Giffee, Phil Herman, Matt Herweck, Michael Joseph, Joey LaPointe, Robert Lilley, Karla Miller, Mike O'Brien, Kim Packard (SWSS), Debbie Trumbull, Jennifer Wall

1. **Minutes**
   Galligan moved and Barry seconded that the minutes from 8/25/21 be approved with the change that Selectboard should be Selectboard. It was approved unanimously.
   Barry moved and Galligan seconded that the minutes from 9/7/21 be approved. The minutes were approved with Collins abstaining.
   Mariano asked whether we got counsel feedback on minutes, Fantasia said that counsel said that any sitting member can vote to approve minutes even if they were not present at the meeting.
2. **Senior Flu Clinic**
   The flu clinic was quite successful with 128 doses administered. Wallgreens did an excellent job and Fantasia thanked them for doing this. In addition, Fantasia got a nice thank you from St. Irene's--although we feel that we should thank them. We didn't get Wallgreens' form until the day of the clinic and that introduced some confusion which made it a bit more difficult. It was suggested to limit the number of people during the first 1/2 hour which often has delays, but it might have been difficult to schedule; in the future it would be good to go over the paperwork in advance.
3. **75 Peter Hans Road (O'Brien) – request to modify existing Deed Restriction to accommodate new addition**
   The septic system has a 4-bedroom capacity. Mike O'Brien is the owner and Miller is the builder, they propose to finish basement rooms which would raise the room count from 12 to 13 rooms which would technically require a 6-bedroom system; however, they are legally grandfathered and while the existing system was designed for 4

bedrooms the field size was increased to accommodate a garbage grinder under local regulations. The renovation would add a playroom for their girls and exercise room with a 1/2 bath. The area only has small basement windows so these rooms could not be classified as bedrooms. There is currently a deed restriction to restrict the property to 4 bedrooms and they are asking to allow 13 rooms rather than 12, keeping the number of bedrooms at 4. Mariano said he is not a fan of deed restrictions since they are difficult to enforce but given that they already have such a restriction we need to consider whether to allow the addition of another room. Barry's perspective is that the rooms added will not have proper windows so cannot be classified as bedrooms, although Mariano noted that Title 5 talks of rooms, not bedrooms. Galligan is concerned that the current system is 22 years old, and they already have a deed restriction. Mariano noted that if the system should fail it would need to be replaced with a 6-bedroom system and he asked whether there was a reserve area that could be used. Fantasia said that this was a repair system which does not require a reserve area so there is no reserve area specified. O'Brien stated that there is plenty of room to put in a bigger septic. Galligan said that would need an engineer's confirmation. The builder asked whether a Title 5 analysis would help. Galligan said a Title 5 analysis doesn't give guarantees; we need to know if a 6-bedroom system could be installed.

Mariano noted that the only change is a finished basement. Fantasia noted that this system was 440 GPD+50% at the time of construction; this qualifies as a six-bedroom system (660 GPD) without a garbage grinder under current regulations; Mariano noted that we could prohibit a garbage grinder. In response to a question by Collins it was noted that the property had two recent Title 5 Inspections, one in 2016 and another in 2019 which found everything in good working condition. Barry moved we impose a garbage grinder deed restriction to accommodate the proposed renovations, Collins seconded it, the motion was approved 4-1 with Galligan opposing.

4. **288 Lowell Street (Guecia) - Deed Restriction request to add rooms**

288 Lowell St is a deed restriction issue. The applicant is not present because they don't zoom. The house has a 3-bedroom septic system and currently has 2 bedrooms. They wish to add a family room, den and 3rd bedroom over an existing garage which will put the house at 8 rooms with 3 bedrooms. The current system is sized for 495 gal/day (three bedrooms with the required garbage grinder allowance), and they would be willing to put in a garbage grinder deed restriction in exchange for the new rooms. Galligan asked the age of the system and whether it has a Title 5 analysis. Fantasia said it was installed in 1998 and has no Title 5 analysis. Mariano asked whether it was similar to the last item. Fantasia said it was but more modest. Galligan suggested that we could require Title 5 inspection. Collins asked if there is a restriction on the den becoming a bedroom. Fantasia said they could never market it as a 4-bedroom house. Barry moved that we add a garbage grinder restriction for 288 Lowell Rd. Galligan proposed an amendment to also add a satisfactory Title 5 inspection as a condition. Collins seconded the amendment, which was then approved 4-1 with Erickson apposed. The motion was then approved unanimously.

5. **Ferns Country Store water update**

Fantasia met with store's owner--Ferns is under a boil water order because of coliform and e-coli. They are working with the state and are looking at the well and septic system. They have posted a sign. The well is old and about 100' deep and will be inspected with a camera tomorrow by Skillings. Matt Herweck, Fern's owner, reported that SWSS (Small Water Systems Services) has done testing and chlorinated the well but have been unable to get a clean set of results. The septic is to be pumped Wednesday, 10/13/21 and inspected by the town. The rest room uses a waterless composting toilet. The coffee brewers go through reverse osmosis which does not solve the problem, but the temperature has been raised above the minimum temperature required by the state. Herweck noted that SWSS indicates that with the heavy rains this summer they have seen an increase in bacteria. There are solutions such a chlorinating the well and UV filtration. They are continuing to explore the problem and are willing to do what the state requires since the well is classified as a Public Water Supply.

6. **Covid 19-status report**

Fantasia reported from 7/1-10/6/21 there were 25 new covid cases with 4 new ones this week. There is nothing really worrisome and the school seems ok. During the same period Concord had 134 cases.

7. **Mask Mandate**

Per our original plan, the BOH revisited the mask mandate at this meeting. Covid Task Force member Barry said that we implemented the mandate at a good time and the numbers are dropping in Massachusetts. Delta is extraordinarily contagious, and it can be hard on even healthy individuals. Experts predict a drop off after Thanksgiving. Barry notes that now that it is fall people will go back to work and we might expect more infection, the question is what is likely in the next month. Mariano asked Jack Huntress about the school. Huntress said that at this point the school is just following guidance from the State which has been extended through November 1. The feared September challenge has not materialized. They are not getting definition at the State or National level. There is currently nothing for the School Committee to decide but at some point, it may be in their hands. Galligan said we have the flu season coming on top of Covid so we may have other respiratory disease to worry about. Galligan sees the long game as air purification but until town building have improved air purification we should continue with masks. Model said that generally the Select Board will follow recommendations of the BOH; technically Town Hall and Police are employed by the Select Board, and the Select Board is in favor of continuing the mask mandate. They are proud of vaccination rates, 97-99% at town hall. The largest employer is the school which does have a mask mandate. Barry asked Fantasia about the experience at town hall--Fantasia said it's not easy wearing a mask all day but it is necessary since most employees are working close to someone else. Kris and Fantasia try to alternate their time in the office. Model said that in his business they do weekly testing and suggested that we could also make testing/home testing kits available. Regular testing in the building would show it to be safe. Barry said we could discuss testing at a future point but in her experience, Antigen COVID testing is considered to be somewhat unreliable. It was suggested that we should look at all things that qualify for the American Rescue Plan Act (ARPA) funding--filtration is extremely expensive particularly for the school which has 100 employees and 600 kids.

Barry said HEPA filters are not too bad and could reduce exposure, but we need town-wide parity. Galligan thinks UVC could be an effective alternative and there are town volunteers who are familiar with the design and procurement of systems. Erickson moved to continue the mask mandate, revisiting it in November, Collins seconded it and it was approved unanimously.

8. Benfield Update

Mariano formed a work group for conditions to permit and approvals that we voted in. They got materials Wednesday and met on Thursday. It wasn't what was expected, and the group is waiting for more input from NOAH. Fantasia has consolidated the workgroup's information requests. NOAH's group will be working on that, and they are looking to finalize their input. Beaudry has proposed to split off the permit approval conditions and move ahead with construction. Beaudry submitted a letter to the board, and we are considering that separation. Frado noted that Beaudry is proposing getting the leach field installed. Disposal is designed and approved by ConsCom--hopefully everything comes together but there would be no discharge until everything is done to the satisfaction of the BOH. Beaudry said he could work on finalizing that narrative as the field is being built, and they are still earnestly moving forward to get more information to the board. Galligan clarified that it is not just treatment documentation but the full package, including escrow and operations and maintenance documents. Carlos Quintal is taking the lead on the pre-treatment system documentation. Carlos has asked if he could consult with Frado to ensure he is going in the right direction. Fantasia and Mariano felt this should be done via a workgroup meeting. Fantasia put together a summary of the workgroup which she sent to the board yesterday it contains some new wording, and she assumes she can get it to Beaudry tomorrow. Frado asked if Beaudry has spoken with installers about their availability, as Linda has given conditional approval of the plan and Rob verified the notes have been corrected.

9. Garrison Place

Fantasia reports that Garrison Place is fully occupied and that all units have been sold. The owner is requesting a cert of compliance on the septic system. The escrow was fully funded last March, the O&M manual has been prepared, and the testing plan for FAST system is done. Fantasia is asking certification of compliance tonight. Partial certificates have been released as the units were sold. Frado said that everything has been done and signed off on so that part of the permit is complete. Total nitrogen should be tested if the system is in a nitrogen sensitive area--which Garrison Place is not, but it is >2000gal/day and has public water so that triggers nitrogen testing.

Joey Lapointe and Debbie Trumbell (SWSS) commented that total nitrogen is tested every 3 years at the test well. Trumbull said the effluent is sampled quarterly for BOD, TSS and pH. Per the I/A/General Use Approval, testing of total nitrogen in the effluent is not required.

Mariano has asked Fantasia in the past and she indicated that most of Carlisle is nitrogen sensitive. Fantasia said Title 5 can be interpreted in several ways and said the FAST system was approved assuming testing for nitrogen, but nitrogen has not been tested. Debbie Trumbull said that the system is not designed to take care of nitrogen specifically. Robert Lille--effluent goes through the FAST system to the tank without reentering the FAST system so currently there is no way to remove the nitrogen. There is nitrogen reduction in the disposal field. BOD and TCSs has remained in compliance but total nitrogen will remain as is. Pretreatment is to deal with BOD and TSS, not nitrogen. Trumbull asks what happens if the BOH wants something different. Mariano we are looking at this from a town wide view and we had assumed that FAST reduced nitrogen, but we need to separate that from the Certificate of Compliance. Galligan notes that Trumbull brings up good points so one thing that Galligan would like to suggest is testing total nitrogen on quarterly basis. It would be good to have a history of system performance should there ever be elevated nitrogen levels detected in the wells. Galligan suggests testing for it, but not making it a regulatory test. LaPointe says it has been, transferred over to the trustees and he doesn't want to volunteer to do extra testing, but he could ask the trustees. Phil Herman for the trustees said they need to get a Certificate of Compliance, if additional testing is needed at this point, then Brendon should do testing. Herman commented that going forward, additional testing might make sense if it were not cost prohibitive. Trumbull estimated that total nitrogen quarterly testing would be about $404/year. Herman thinks that is reasonable but can't speak for trustees. Ayres and Boucher, trustees, agreed that quarterly testing could be considered with the understanding there is no regulatory standard requirement, and the data would be for historical purposes as an indicator of performance. Galligan moved to issue the certificate of compliance for Garrison Place, Barry seconded, approved unanimously.

10. **Glass Grinder**

The Transfer Station Task Force reported that glass is no longer being recycled and now goes to landfill. The town is considering purchasing a glass grinding machine and grinding it to a safe size to make it available for use by town residents for construction. Noise and airborne dust during grinding are concerns. Collins noted that if there is no demand for product (ground glass), the expense and energy input are not worthwhile. Other towns have mixed it with road sand, but there were complaints from residents about the residue. Since there didn't seem to be an identifiable use for ground glass the BOH declined to endorse buying a glass grinder.

11. **Nitrogen**

Collins would like a general discussion of nitrogen in the context of bigger properties. It will be put on a future agenda.

12. **Adjourn**

The next meeting is October 27, 2021.
Barry moved to adjourn, Collins seconded, it was approved unanimously, and the meeting adjourned at 21:58
Respectfully submitted,

David Erickson,
Recorder

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

MEETING CANCELLED due to conflict with COVID Vaccination Clinic

BOARD OF HEALTH
Meeting Agenda
Wednesday, November 10, 2021 v 3
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/84298206729

Meeting ID: 842 9820 6729
One tap mobile
+13017158592,,84298206729# US (Washington DC)
+13126266799,,84298206729# US (Chicago)

Dial by your location
+1 929 205 6099 US (New York)

7:00	**Minutes**
7:15	Clark Farm Stand – septic system permit
7:45	0 South Street – Senior Residential Open Space presentation

DISSCUSSION ITEMS

Benfield Farms Leach Field Installation – update
PFA's status report
COVID-19 town status

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/1/21, 12/15/21
Upcoming:

BOARD OF HEALTH
Minutes for Tuesday, November 16, 2021, 7:00 PM
Remote Participation

7:00 **Minutes** 10/27/21

7:15 Clark Farm Stand – septic system permit - (Geoffrey Freeman)

7:45 0 South Street – Senior Residential Open Space Application
(Hancock Engineering – Brian Geaudreau)

8:00 **DISSCUSSION ITEMS**
- Benfield Farms Leach Field Installation – update
- PFA's status report – to be rescheduled

8:10 COVID-19 - town status

NEW BUSINESS

8:40 **Executive Session** pursuant to M. G. L. c. 30A sec. 21(a)(3) for the purpose of discussing strategy with respect to litigation since an open meeting may have a detrimental effect on the litigating position of the Board

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean J Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Fantasia Health Agent, Kris Gines, Rob Frado, M.L. Bohn, Donna Brewer, Christopher Buono, Geoff Freeman, Brian Geaudreau, Meg Howes, Marjii, Tricia McGean, Derek Zanga, Kathy Chick

1. **Minutes**
   Changes to the 10/27/21 minutes were discussed and incorporated into the minutes, Barry moved to approve the amended minutes, Galligan seconded the motion which was then approved unanimously. Other outstanding minutes were tabled until the next meeting.
2. **Clark Farm stand septic system permit**
   Mariano explained that Clark Farm has a septic system design request for the Farm Stand before the board which raises the question of whether the water supply well becomes a becomes a public water supply. Geoff Freeman is present to answer questions about the farm market and explained that they applied for the septic system to deal with gray water. They would like to put an indoor washing station for vegetables but since Carlisle does not recognize gray water specifically, they need a septic system with a leaching field, and they have reserved land for a leaching field. The farm market is not otherwise changing their operation but one of the issues in designing the field was that Stamski & McNary needed to come up with a flow rate and since the system would only be used for vegetables and washing up (portable toilets are used at events) they came up with a flow rate below the minimum required by the Town. Freeman said they do host private events, but portable toilets are provided at those events. He thinks they have had about 7 events. Stamski pointed out that there is no change in their program and that their usage is below the minimum to qualify as a public water supply. They have been working with a food safety consultant (Meg Howes) and they do take out a 1-day permit when they hold events, which currently represents about 2% of their revenue. They do not prepare or serve food and they use bottled water for making coffee. Galligan suggested a restriction to prevent adding a bathroom and Freeman said that there are codes in effect and that they could not put in a bathroom in without a plumbing and building permits. Mariano noted that the food service/inspection issues are understood, and the only question is what triggers a public water supply. Again, Freeman notes that their water use is below the minimum for a public water supply, and they don't have a site suitable for a public water well. Barry raised the concern that if a leaching field is installed then the state might say they should have a public water supply. It would

be good to ensure that the state is on board to avoid problems down the line. Freeman did ask where he could put in a public water supply and Marjie said the cost of putting it in would probably put them under. Mariano asked Fantasia where we stand with the septic design, Fantasia said the design is complete. Galligan said that it is too late to start a septic system now so it might be worth having Fantasia check with the DEP. Fantasia will check with the DEP and assuming a green light from them she could then issue a permit to move forward in March.

3. **0 South Street - Senior Residential Open Space Application**

Christopher Buono is the developer and Brian Geaudreau is the engineer representing South Street Carlisle 11c, the South Street senior housing development. The development will be on a parcel of land off South Streets. The have a wetlands determination and will be meeting with the Planning Board in December. They were asked to come before the BOH. There are issues of a public water supply versus a private water supply and septic system issues. The parcel is 24.7acres and is bisected by wetlands. It is undulating and predominantly wooded. They have done extensive soil testing in 2015/2016 which was witnessed by Stamski & McNary. They have gone back and forth between single family lots versus an open space subdivision and have opted for an open space subdivision. 17.9 acres would not be developed and there is town owned land at the property line. They are planning on developing it as 2 projects, each with their own homeowner's association and independent wells and septic systems. Each project would have 3 two-bedroom duplexes for a total of twelve bedrooms accommodating 24 people in each project. Each well will serve 12 bedrooms and 24 people so the wells will be private water supplies and each septic is designed for 12 bedrooms at 1980 gallons per day. Mariano noted that what they are showing on screen conforms to regulations and should not need waivers. Galligan asked if there is a septic duplication area and Geaudreau said each project has a primary and reserve system area. Mariano noted that we have seen difficulties scaling up large systems, so he appreciated that this is being done using 2 smaller systems. Fantasia pointed out that from a BOH perspective this is one project with a single permit. The board needs to carefully consider the project as a whole and not as two separate projects. As soon as you hit 2000 gallons/day you need to do ground water mounding studies. The project is so close to 2000 gpd (flows of 1980 gpd) the state should be consulted. This is similar to Birch Farm, where the state made the determination on private vs. public water supply. The engineer agreed to work follow up with Linda and get in touch with the state.

4. **Benfield Farms Leach Field Installation - update**

Installation seems to be going well, Mariano thinks the contractor is doing a great job. It was clearly clean sand being brought in, and everything was staged well. He was shown the excavation of areas of tight soils that are believed to be the cause of the last failure. He could see that the lenses and pockets of hard packed material were being removed. They were in the process of flushing the force main, they had done one flush and put in pool shock chemicals to clean out the main and were letting it sit before flushing again. There was some discussion of where they are at and it sounds like everything is going smoothly and on schedule, the field should be completed by Nov 30, as required. No discharge will be allowed until the pretreatment process is developed and approved and all BOH conditions are met. It is important to finalize this as quickly as possible as you don't want to leave the system unused.

5. **PFAS status**

There is not much new information, sampling is going on and we are waiting to get more information from the state. Fantasia said residents are continuing to test.

6. **Covid 19**

Mariano said we need to vote on maintaining the mask mandate. Mariano's view is that we implemented this in response to Delta and as he doesn't think it is as much of a threat, he would like to consider backing off and making it a recommendation--just having the sign "Please wear a mask" could be effective. McGean said Lincoln wants to talk about dropping the mandate once Middlesex numbers drop but they are still high. Sudbury still has an indoor mandate, Concord does not. Collins said we talked about this for several months, a month ago things seemed to flatten out but from the information he can find the NH/VT numbers are going wild, he doesn't think this is the time to relax the mandate. Galligan screen-shared a CDC resource that shows high community transmission in Middlesex county. Fantasia said that Middlesex has large towns with low vaccination rates so she would be cautious about looking at Middlesex as a whole. Galligan would agree if we stayed within our boundaries, but we go to other areas--if we all stayed in Carlisle she would be more comfortable. Barry lost internet connection during much of the conversation re: mask mandate and was unable to hear or participate. When she was able to rejoin the meeting Barry noted that the mask mandate was proposed in late August by the BOH in response to the new delta variant and in anticipation of a rise in COVID cases when residents returned to school and work in September. It was not intended as a long term solution. Barry felt that based on the unremarkable recent case numbers presented by Tricia McGean (public health

nurse), we should discontinue the mask mandate in favor of a "strong recommendation" to wear masks in public indoor spaces.

Erickson moved to reconsider the mandate at the next meeting, and Collins seconded. Barry said she would lean toward a strong recommendation at which point Erickson withdrew his motion to allow consideration of relaxing the mandate. Galligan then moved to continue the mask mandate and review it in early January. Collins seconded the motion and it passed 3-2 with Barry and Mariano voting against.

Kathy Chick, representing the Carlisle Chamber Orchestra, said this decision will affect upcoming concerts. The orchestra has been performing with String players and everyone is required to be vaccinated. The orchestra needs to get the wind players back, if not, they will lose the orchestra. They do take precautions; they don't use the first rows and don't allow standing around socializing. After further discussion, Barry moved to allow activities in which a performer or speaker can remove their mask while performing/speaking, the motion was approved unanimously.

7. Executive Session

It was moved (Erickson) and seconded (Collins) to go into Executive Sessions pursuant to M. G. L. c. 30A sec. 21(a)(3) for the purpose of discussing strategy with respect to litigation since an open meeting may have a detrimental effect on the litigating position of the Board. Roll Call: Aye – Barry, Collins, Erickson, Galligan, Mariano. Motion passed 5-0-0.

The Board announced it would not return to public session. Next meetings are set for 12/01/21, and 12/15/21.
The public meeting was adjourned at 21:19.

Respectfully submitted,

David Erickson,
Recorder

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

MEETING CANCELLED due to conflict with COVID Vaccination Clinic

BOARD OF HEALTH
Meeting Agenda
Wednesday, November 17, 2021
7:00 PM
REMOTE PARTICIPATION

https://us02web.zoom.us/j/86574678913

Meeting ID: 865 7467 8913
One tap mobile
+19292056099,,86574678913# US (New York)

Dial by your location
+1 929 205 6099 US (New York)
Meeting ID: 865 7467 8913

7:00	**Minutes**
7:15	Clark Farm Stand – septic system permit
7:45	0 South Street – Senior Residential Open Space presentation

DISSCUSSION ITEMS

Benfield Farms Leach Field Installation – update
PFA's status report
COVID-19 town status

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Meeting Dates - 12/15/21
Upcoming:

BOARD OF HEALTH
Minutes for Tuesday, December 15, 2021, 7:00 PM
Remote Participation

7:00	**Minutes**: **10/6/21; 11/16/21**
7:15	COVID-19 – discussion ▪ Community Status ▪ Mask Mandate ▪ Booster Clinic
8:00	Benfield Farms Septic Upgrade ▪ FAST Permit Conditions (tabled) ▪ Installation Summary Report (Frado)
8:20	646 South Street – Request for Garbage Grinder Deed Restriction (tentative)
8:40	19 Bellows Hill Road – Request for Emergency Septic Upgrade (Chesleigh)

DISCUSSION ITEMS
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean J Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Fantasia Health Agent, Wanda Avril, Michael and Amoreena Chesleigh, Rob Frado, Michael Joseph, David Model, Ginny Turner, K. Zinke,

1. **Minutes**
   It is a violation of the open meeting laws (OLM) for a quorum of board members to have a discussion on any board related matter. This means that that no board member can speak to more than one other member about a topic. OML also prohibits the polling of members one at a time in order to solicit a decision. In the future comments on draft minutes will be sent to Fantasia who will then create a final draft for approval at the next meeting. Barry moved to approve the 11/6/21 minutes as amended; Erickson seconded the motion, which was then approved unanimously. Galligan moved to approve the 10/06/21 minutes as amended which was seconded and approved.
2. **Covid-19**
   Fantasia reported that Concord had 19 cases in the last 7 days (315 since 7/1), Carlisle had 10 in the last 7 days (69 since 7/1), and Lincoln had 71 cases since 7/1. We are definitely seeing an uptick and according to MAVEN most cases are the Delta variant. The school is also seeing cases of COVID. They are doing pool testing; out of 300 pool testing candidates they had 1 positive.
   There have been 4 Concord/Carlisle clinics with 700 doses in the first clinic and 800 doses in the second (about 200 of the total were Carlisle students). Fantasia has submitted an application to the State for a mobile booster clinic but has not heard anything; the State has been overwhelmed with requests. Even though it would be nice to have local Carlisle clinic Public Health Nurse (PHN) McGean has submitted an application for a Tri-Town booster clinic which the state might be more favorable to. Both applications are in, and we hope they move forward. The MA Community Tracing Collaborative (CTC) has been disbanded so the PHN is now managing all contact tracing for local MAVEN cases. The state has removed a lot of the follow up requirements. The school

nurse is managing students identified in pool testing, and McGean, Fantasia, and Gines will do initial notifications for MAVEN cases. It was reported that an individual on the CCHS swim team tested positive and the entire team had to be quarantined. Fantasia has asked McGean to let us know if she is overwhelmed. Fantasia sent the call notes from DPH call Tuesday, 12/15. There was little information on Omicron. The State will be providing home test kits starting with socially disadvantaged towns.

Barry noted that now positive antigen tests don't need to be followed up with PCR tests and Fantasia noted that even probable cases are now treated as confirmed. The state has implemented a new notification system Mass Notify. Once the App is installed on your phone you will receive an alert if you have come in close contact with someone who tested positive. There is no real way, however, for the state to follow up on identified close contacts. People would be expected to do the appropriate self-monitoring and testing. Barry said that most of the cases in Carlisle are mild because of our high vaccination rates. Fantasia said Carlisle did have 1 death related to COVID-19, but the patient had other health issues. A drawback to the home or rapid tests was noted - without PCR follow up these cases won't get counted in MAVEN, making MAVEN's case counts artificially low, but hospitalizations are way up. On the antigen test 2 of 5 people who are positive have no symptoms. The Fire Dept. is planning on continuing to offer PCR testing for residents and workers in town. Fantasia said the BOH should state its support for continuing the PCR testing. Barry agreed commenting that she has only heard good things about the service. Fantasia said that right now the town is carrying the cost, assuming that we will eventually be reimbursed with Federal funds, but it is expensive.

Mariano asked whether we have a tally on youth vaccinations and how that affects our vaccination rate. Fantasia said it was on the State web site, 220 aged 12-15years had at least one shot. The grade school has a population of approximately 450 including the 200 7th and 8th graders that got vaccinated earlier. Fantasia said people were having a hard time getting appointments at pharmacies. The Board would like to have vaccination data on the 5-11 year olds for the next meeting. In terms of reviewing the mask mandate, we decided to wait until January, in line with the vote taken on 11/16.

Barry said that data released today indicates for Omicron, the likelihood of infection for people having received Moderna with the booster is comparable to the Delta variant without the booster. For Moderna the booster is a 1/2 dose. The nature of the immune response is somewhat different, possibly getting longer lasting T cell immunity.

3. **PFAS**

Fantasia said the retesting of a resident's well came out much higher and the State is installing a filtration system. Barry spoke to the homeowner, who didn't remove the aerator before obtaining the water sample. Fantasia mentioned other houses were slightly elevated, but the library was over 100 both times and Concord Rd was 90. One Chelmsford public water supply was tested at 21ppt. Fantasia is getting a lot of inquiries from residents and doesn't feel she has good information to give them. Mariano said we need to follow up with the State.

4. **Fern's Country Store**

There is no real update; they still have a boil water order and have not filed for a new well location yet.

5. **Benfield Farms Septic Upgrade**

Frado said the septic field is completed. He had a look today and the entire field has been hydro-seeded and covered with hay. Rob Sarmanian of Oakson came out and checked the filter and put pool shock into the pump chamber and let it sit overnight, it seemed to clean up the lines pretty well, the pump water began a little dirty, but it gradually got clearer and clearer, so he thinks it did a pretty good job. The electric boxes, manifold, and everything else is in. When preparing the bed, the impermeable material was easy to identify. Frado basically watched every scoop and could say to dig a little deeper when necessary, going from 4' to 7' to get to good material. 2000 cubic yards were brought in and Frado is confident that they got most if not all of the impermeable material. We still need to get an as built final grade from Mark Beaudry and Frado thinks there should be bird boxes to mark the corners of the new field. There should be monuments over the new monitoring wells and plastic manhole cover, and inspection port in the middle of the field--these all need to be noted in the Final As Built as well. Frado doesn't think that we have a decommissioning report on the old wells. Beaudry needs to supply all of that.

Fantasia has told Beaudry that he still has a few things to provide. Mariano would like information on how the monitoring wells are constructed: their depth, whether they have filter packing, and did they hit bedrock. Frado thinks Beaudry needs to be reminded to take care of these items.

Fantasia will inform Beaudry of the approval for the field, but that the BOH is not ready to send waste to the leach field until it gets the additional items noted (O&M plan, startup plan, etc.). A draft start up plan for the FAST just came in today and the work group needs to review it before bringing it before the board, also we need to ensure that finances have been resolved. Fantasia sees 2 steps: 1-a system restart permit and then 2-certificate of compliance after 1 yr. of monitoring. Galligan said they have not produced the O&M-- Mariano asked Fantasia to remind Mark that we need the O&M.

Mariano who had visited the site was surprised at how easy it was to identify bad material. Frado was surprised at how much there was, but it has been removed and Mariano was happy to see clean Title 5 sand. Frado said the cut showed how variable the soil was; last time poor fill material was used on top of some bad soils; this time the entire field was excavated. The work group meeting will be next week. Galligan raised concern about the field sitting unused over the winter, and Frado said that Sarmanian did operate the pumps and checked the hydraulic system. There was a question of whether there could be a problem with freezing (normally effluent would warm the field) but there is about 6" of sand and 9-10" of topsoil over the field and while we could have 4' of frost Frado has never seen it that deep.

6. **19 Bellows Hill Rd.**

The septic system has failed. Wind River has confirmed the failure and has designed a new system, but November 18th is too late for a winter installation. The system is a pumped system with a 1500-gallon septic tank and a 1000-gallon pump tank. The homeowners (Michael and Amoreena Chesleigh) need to go to a tight tank and pump until the system can be replaced after March 1 when we allow installation to begin. They will check with their installer on converting the tank to a tight tank and produce a pumping schedule for the interim.

7. **Title 5 training**

Fantasia will try to set up a Title 5 training session.

8. **New Business**

In other new business, Mariano noted that Galligan has been working behind the scenes on air purification systems for town hall. With the BOH's support, Galligan had reached out to Goddard in September about using ARPA funding to improve air quality; Goddard agreed this was a worthwhile project. Fortunately, we have a couple of knowledgeable volunteers spearheading this effort. Galligan and Fantasia met with Bill Risso who installed a UCV purification system at 51 Walden, and Alan Lewis who is familiar with and on the standards committee for these types of systems. Both have worked with companies that supply such systems and are scoping out equipment and will draft a proposal for the ARPA funding committee Fantasia thanked Galligan for getting a small air purifier for the BOH office, so they don't need to wear masks 100% of the time.

9. **Adjourn**

Next meetings are set for 01/05/21, and 01/19/21

Barry moved to adjourn, Galligan seconded, meeting adjourned at 20:55

Respectfully submitted,

David Erickson,
Recorder

BOARD OF HEALTH
Minutes for Wednesday, January 12, 2022, 7:00 PM
Remote Participation

7:00 Minutes 12/15/21,

7:15 COVID-19
- Community Status
- Mask Mandate
- ARPA Funding
- Remote meetings
- General Updates

7:45 Benfield Farms Septic Upgrade
- FAST Permit Conditions – final draft

DISSCUSSION ITEMS
- FY23 Budget Preparation
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean J Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Fantasia Health Agent, Wanda Avril, Rob Frado, Phil Giffee, Alan Lewis, Ginny Turner

1. **Minutes**
   Mariano said he would prefer to see less detail of the discussions in the minutes. Galligan moved to approve the minutes of 12/15/21 as amended, it was seconded and approved unanimously.
2. **Covid-19**
   Last Thursday we had a fifth clinic with Concord, vaccinating 415 people, mainly adults (largely college students). We have had a dramatic surge in cases, 123 in December and 142 from Jan 1-Jan 10, 2022. The Fire Department is managing. The school is doing a tremendous job in keeping up with their cases, although there is talk of not following up on contact tracing but only calling people with positive results. People should isolate for 5 days, onset of symptoms or date of test is day 0 and then mask until day 10, most people are not having serious symptoms. Fantasia thinks about we have about an 85% vaccination rate, it is very high, and we have done a lot of kids--parents are getting kids vaccinated but despite this we have the highest case rate ever.
   After a discussion of case rates, mask effectiveness, and air purifiers Galligan moved to continue the mask mandate to be reviewed at the end of February. Barry seconded the motion which was approved unanimously.
3. **ARPA Funding**
   Lewis and others are trying to get ARPA funding for air filtration systems which will be sponsored by the BOH. We have been in touch with the ARPA committee. Alan Lewis said there are three different technologies being considered. One is an encapsulated UV system integrated into the air handling system and where facilities is talking about revamping the air handling that may be the way to go. The second system is a ceiling installed titanium dioxide system with a fan bringing air through the titanium dioxide. We do have a quote, but Lewis is not happy with the data on effectiveness, the data are not scientifically robust and are poorly documented. The

third system uses short wavelength UV which is harmless to humans but would require about 120 fixtures in the ceiling of the Town Hall which could be prohibitively expensive. Finally, a fourth system is a small portable Aleddra system using titanium dioxide irradiated with LEDs--it can handle offices of up to 100 sq. feet and could be very cost effective. Titanium dioxide kills bacteria and neutralizes the virus--it's a very effective system and it also works on mold--titanium dioxide has been used for a long time with exposure to short or long wave radiation. Galligan expressed concern about possibly harmful byproducts. Lewis said ozone is one concern, but this system does not produce ozone or VOCs.

4. **Remote Meetings**

   Fantasia said that the Select Board asked whether we would recommend remote meetings. After some discussion we decided that we do recommend remote meetings at this time and Mariano asked Fantasia to relay that we currently recommend virtual meetings during this period of the Omicron variant, but we will reconsider next month.

5. **Benfield Farms Septic Upgrade**

   Fantasia, Galligan, Frado, and Mariano met in person with Carlos Quintal (the engineer overseeing the system startup and stabilization). Frado reported that at that meeting, Carlos clarified the operational chart and responsibilities and reiterated that he is taking the lead in ensuring that things are being properly managed and monitored. The automatic pH monitoring system was scheduled for installation by Jan 3, but Frado doesn't think that has happened and the system can't start up with pH monitoring. There is also concern about maintaining continuity if NOAH's employees or contractors get sick or quit. Title 5 also requires pressure testing the force main so Beaudry will need to coordinate that with the board.

   Galligan raised a concern that historically, BOH has not received sample test results the indicate system performance in a timely manner. BOH should have test results for a specific month within 2 weeks of the month end. Carlos anticipates that, per his timeline, by the end of May he should have a handle on whether the FAST 0.9 system needs to be installed for nitrogen reduction. Galligan wanted to ensure that Frado would be part of the field work startup and we also want it to be very clear what happens when system goes out of control--there should be a trouble shooting guide. Carlos said testing of the monitoring wells would be quarterly or monthly but monthly for the start up. Mariano said the work group feels comfortable that we are on the same page with Carlos and that we should approve the startup and give them a go ahead with the caveat that Fantasia and Frado must approve it before actual discharge. Galligan expressed confidence in Carlos and moved that we authorize the startup of the Benfield Farms system contingent on a letter to be sent to NOAH, Barry seconded the motion. Frado said to be sure to include pressure testing, and Galligan noted the need for an electrical permit, and these should be in the letter. Mariano said Fantasia can put that together. It passed unanimously with Collins recusing himself.

6. **FY23 budget**

   The Select Board felt we acted out of turn by changing counter drop-in hours without Select Board approval, but Mariano disagreed, and the Town Council supported Mariano's views. David Model has acknowledged to Mariano that if the Health Department is to stay with full service, more hours are needed. The Select Board will put us on a future agenda to discuss workflow and budget needs. We are asking for an additional 6 hours of Gines' time but even that may not be enough to go back to full time as drop-in hours are very inefficient. Hopefully, this can lead to better communications between the Select Board and the BOH.

7. **PFA's status**

   Mariano reported not much has changed; we are waiting on the state for the treatment of wells. Fantasia said we continue to get additional household tests. Fantasia will get an update from the state before our next meeting to get the State's opinion of where Carlisle stands, the town of Princeton is having similar issues. A brief update on PFAs should be on future meeting agendas.

8. **Fern's Country Store - Well update**

   The boiled water order was rescinded by DEP because there were multiple tests with no E. coli. Ferns still plan to relocate the well, but we don't know the status. Mariano is concerned that in our discussion with the state they mentioned that E. coli is usually an indicator of a problem but not the sole problem. For example, a breach in the

well casing could admit other contaminants. Ferns is looking into filtration systems with SWSS and Linda with check in with SWSS. The DEP is keeping a close eye on this situation.

9. **New business**
   Fantasia said we need to make a comment on rapid at-home tests and coordinate with the Fire Department if it is appropriate to make rapid tests available. It's a matter of who will place the order and who is going to get the tests. Fantasia said a lot of people tested positive with at home tests and then went in for a PCR test, which is unnecessary.
10. **Update on Public Health Grant**
    Sudbury has 5 positions that they would like to bring on, they will be a meeting tomorrow at 8:30 and hopefully they will be approved tomorrow
11. **Adjourn**
    Next meetings are set for 01/24/21
    Barry moved to adjourn, Galligan seconded, meeting adjourned at 21:09
    Respectfully submitted,

    David Erickson,
    Recorder

BOARD OF HEALTH
Minutes for Wednesday, January 24, 2022, 7:00 PM
Remote Participation

7:00 Minutes: 1/12/22 (tentative)
Board of Health Communication

7:15 COVID-19 – discussion
- Community Status
- Revised Guidance
- Community Events
  - Gleason Library (Martha Patten-Feeney)

8:00 Clark Farm Stand – Water Supply Question

DISSCUSSION ITEMS
- Liaison Reports
- PFA's status report
- Fern's Country Store – Well update

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean J Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Fantasia Health Agent, Martha Feeney-Patten, Geoff Freeman, Margie Findlay, Sarah Hart (Mosquito), Meg Howes, Joey LaPointe, Gary LaPointe

1. **Minutes**
   Minutes for 1/12/22 were tabled until the next meeting. In the future, I will BCC the draft minutes to all members of the BOH.
2. **Covid-19**
   Fantasia reported that cases have spiked, there were 263 cases reported in January 2022, about 40% of the 646 cases reported to MAVEN since January 2020. The Fire Department has been doing a fantastic job, especially since a lot of tests they do are negative. People are also increasingly using rapid at home tests, so the numbers are in fact higher than being reported to MAVEN.
   Due to the surge in local COVID cases in January, Fantasia has been unable to keep up with the MAVEN follow up calls, so it is necessary to prioritize the calls based on age, family clusters and school connections. Fantasia said that 99% of the responses she gets were from people who weren't seriously ill and who were aware of the guidelines. What we have seems to be working well in Carlisle and the Fire Department will continue testing, at least for a while. Trisha McGean was not present but reported 143 cases from 1/5-1/12 and 103 from 1/13-1/19; she is tracking it through the school but none of these numbers reflect at home tests which are not reportable in MAVEN.
   There was a discussion of test availability, and it seems that tests are now more readily available, so it was suggested that we hold off on purchasing tests. The BOH did not revise its mask guidance at this time but asked Fantasia to check on state recommendations.
3. **Gleason Library**
   Martha Feeney-Patten said the library would like to get back to having events and would like to have a reception, with snacks, in March. After some discussion the BOH agreed that it seemed reasonable to plan the event assuming people would be masked (assuming the mask mandate is still in place) except when eating or drinking.

4. **Clark Farm Stand**
   Fantasia got feedback from the state that the proposed septic system will not trigger a public water supply if there are no public restrooms. The proposed grey water system will serve as a handwashing sink for employees only. After some discussion the BOH agreed and said that Fantasia can issue a Title 5 construction permit with conditions prohibiting the installation of a restroom or changes in operation without BOH prior approval. The Farm Stand is inspected annually by the Health Dept and the private well is tested annually as required under the Food Code. Portable restrooms will be provided for private catered events and caterer notification must be submitted to the Health Dept. for each event.
5. **PFA's status**
   There is nothing new from the State on PFAs testing in Carlisle nor on the status of the treatment plans for a local household with extremely high levels. It was noted that the library had a quote of $10,000 to design a treatment system. That seemed high and Mariano suggested they get other estimates. There was also a discussion of waste from water treatment--there seems to be no good resolution on how to treat such waste. Mariano would like to see the State do an open presentation to talk about what they are doing.
6. **Fern's Country Store - Well update**
   Fantasia said they are still trying to get a new water source but there is no clear timeline. They currently are using bottled water for potable use but well water general household use.
7. **New business**
   Benfield Farms - According to the residents, Benfield has an indoor air quality issue, possibly due to lack of maintenance of the air filters in each apartment. The residents are conducting a survey to see which apartments are affected. At this point it is hard to know what should be before the BOH as an enforcement issue and what should be before NOAH as owner of the facility. The residents are currently tabulating survey results, so we hope to have more information in the future.
   Garrison Place - Collins agreed to look at the Garrison Place O&M manual. Stamski and McNary put the manual together and Fantasia thinks it is adequate but would like Collins to review it.
8. **Adjourn**
   Next meetings are set for 02/09/22 and 2/23/22.1
   Galligan moved to adjourn, Collins seconded, meeting adjourned at 20:42
   Respectfully submitted,

   David Erickson,
   Recorder

BOARD OF HEALTH
Minutes for Wednesday, February 23, 2022, 7:00 PM
Remote Participation

7:00 Community Input

7:05 COVID-19 – discussion
- Community Status
- Mask Mandate Discussion

7:30 PH 147 Westford Street – septic system upgrade requiring Local Waiver
- 15.211 Distances – leaching area 91' from wetlands, 100' required

DISSCUSSION ITEMS
- FY23 Budget Update
- PFA's status report
- Minutes:2/9/22
- Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Jean J Barry, David Erickson, Catherine Galligan
Attendance nonmembers: Fantasia Health Agent, Nathanial Cataldo, Rob Frado, Chris Johnson, Amy Livens, Tricia McGean

1. **Community Input**
   At 19:04 Erickson opened the meeting.
   Amy Livens made the following statement:
   "I feel it is appropriate at this time for Carlisle's mask mandate to be lifted. We are in a different place then we were in 2020 and 2021. We now have therapies, data, high vaccination rates and natural immunity. My biggest concern is for our children's mental health. They have been greatly affected by the pandemic. Children, like us all, need to see faces and connect. Please set a date to give us hope! Please consider following Governor Baker's deadline of dropping mask mandate on February 28th."
2. **Covid-19**
   Fantasia said that from Jan 1, 2020 - Dec 31, 2021, there were 374 confirmed cases. There were 284 confirmed cases in Jan 2022 but from Feb 1,2022 to Feb 19 there were only 21 cases, and many were family members of infected people, although there are many family members who are doing rapid home testing and whose numbers are therefore unknown. When McGean talks to people they frequently say others in the family were infected. Fortunately, there have been no hospitalizations due to the Omicron variant and McGean confirms that most cases are mild with a moderate fever for a few days and sinus infection-like issues. Most cases start with a scratchy throat. Barry recommends changing from a mandate to an advisory effective no later than the end of February. See attached notes.
   After some continuing discussion Barry moved to lift the mask mandate effective immediately and establish a mask advisory consistent with the CDC & Massachusetts Department of Public Health. Galligan seconded the motion which was then approved unanimously.
3. **147 Westford Street**
   Galligan moved to open the public hearing for 147 Westford Street, the motion was seconded and approved

Cataldo was present for Stamski and McNary. There was a question that came up in the afternoon as to whether the system was in a 500-year flood plain. There was some discussion of this but it was eventually stated that the site chosen is probably the best site on the property and is in any case an improvement over the previous system and is in compliance with State requirements and so does not require a state waiver. Frado was comfortable with the assumptions being made. Cataldo agreed to keep the PH open to allow for the Conservation Commission scheduled meeting.

Galligan moved to approve plan entitled "Sewage Disposal Plan, 147 Westford Street, Map 15, Parcel 43-3, designed by Stamski & McNary, Inc. revised February 16, 2022 and grant a setback waiver from leach field to wetlands (91' provided; 100' required) under local upgrade approval, contingent on a floor plan verifying the house is a 4-bedroom house and an Order of Conditions from the Conservation Commission that would not affect the septic system design. Barry seconded the motion which was then approved unanimously.

4. **FY23 Budged Update**

Galligan attended the Select Board/FinComm meeting discussing the town operational budget. The BOH had asked for a total of 11 additional hours, going from 24 to 35 hours/week. Of those hours, 8.5 would come from the tax base and 2.5 from 53c account. The Select Board was amenable to more hours, but FinCom was not in support noting that the BOH had received a 15% increase in the operating budget for FY22 (this was for the Public Health Nurse position, which had previous y been funded by pilot grants for multiple years). FinCom eventually included a 9.1% increase (as opposed to the 12.3% requested). It is a step in the right direction but we will continue to try to communicate why we need the full amount requested.

5. **PFA's status**

Fantasia and Kris attended a DEP workshop this morning and have sent out a link. Fantasia noted that the state does not currently regulate private wells. There is a Model Private Well Guideline that many communities use. There is also a Bill before the Legislature for a uniform code for private wells similar to what Title 5 does for septic system. A uniform code would still allow for more stringent local regulations.

Administrative reports

Fantasia provided a document detailing the administrative reports. Fantasia summarized the report, but I am copying it here for the record:

Minutes

2/9/22 minutes: It was noted that Ginny Turner should be added to the list of attendees. Galligan moved to accept the amended minutes, Barry seconded, and the motion was approved unanimously.

Adjourn

Next meeting is set for 3/09/22.

Barry moved to adjourn, Galligan seconded, meeting adjourned at 20:26

Respectfully submitted,

David Erickson,
Recorder

Meeting Materials

ADMINISTRATIVE REPORTS
February 23, 2022

Public Health Excellence Grant – We have hired Kelly Cael as the Grant Coordinator. Kelly was the former health director in Hopkinton and managed a similar grant collaborative. We are in the process of preparing a mission statement and goals so we have a road map on future activities. Next step will be to hire a FT Inspector and FT PHN.

Assistant Health Agent – report from Select Board meeting 2/22/22. (Galligan)

Ongoing Projects

Large Development Compliance
Operations and Maintenance Template
Presentation on PFAs
Ferns PWS

Mask Mandate Notes (JBarry)

Carlisle Mask Mandate 2/23/22

Recommendation:
Change the mask mandate to a MASK ADVISORY–follow the metrics set out by the CDC & Mass DPH, effective no later than 2/28/22.

- Masks= "no real (physical) harm" but over a period of time it can have a significant negative impact on our psyche
- Ongoing mandate–could have negative consequences with regard to compliance if the DPH/BOH needs to recommend future unpleasant restrictions in the event of a future surge (e.g. next Fall/Winter)
- Mask Mandate=should be a temporary measure, used during a time of extreme danger (e.g. during the Delta + Omicron surge). We need to be able to pivot quickly and reverse course when the time is right.
- Masks will not disappear by recommending an advisory, just not mandated. We will all continue to wear masks in high risk situations (e.g. indoor activities, medical facilities, etc.)
- IN SYNCH with current CDC + Mass DPH guidelines (masks are recommended for high risk individuals and anyone unvaccinated, indoors in areas where cases are high). There have never been any federal mask mandates and MA has not had a mask mandate since 2020.
- IN SYNCH with DESE + Carlisle School (who submitted a request with DESE to end their mask mandate).
- IN SYNCH with surrounding towns (e.g. Concord + Westford) who established a mask mandate during Omicron surge and recently lifted the mandate.
- COVID-19 Vaccine Boosters–recent studies show that boosters maintain a strong T cell response against many COVID-19 variants (even better than with natural infection)
- Omicron re-infections are rare, including with the BA.2 variant (according to a recently published Danish study)
- Background Immunity–very high rate of vaccination/boosters in town, very high rate of exposure to various subtypes of COVID-19. We should not delay lifting the mandate for fear of the *possibility* of a future variant that *could* be dangerous.
- TAKE HOME POINT: mask mandates (or any other type of mandate) should be used judiciously during times of extreme danger. We need to take care when using such tools and not overuse or abuse them.

BOARD OF HEALTH
Minutes for Wednesday, March 23, 2022, 7:00 PM
Remote Participation

7:00 Community Input

7:05 COVID-19 - community status

7:15 Town Meeting COVID Planning – Wayne Davis, Moderator

7:30 Ferns Country Store – Public Water Supply update (Herweck)

DISCUSSION ITEMS

Financials

- 53E Revolving Cap
- FY23 Operating Budget – staffing
- FY21 Year End Memo

Minutes: 3/9/23

Administrative Reports

NEW BUSINESS

The meeting agenda lists all topics reasonably anticipated by the Board of Health at the time of posting. Additional topics not anticipated may be discussed at the meeting under the agenda item New Business.

Attendance members: Tony Mariano Chairman, Jean Barry, Patrick Collins, David Erickson, Catherine Galligan
Attendance nonmembers: Linda Fantasia Health Agent, Wanda Avril (Carlisle Mosquito), Wayne Davis, Matt Herweck, Michael Joseph

1. **Community Input**
   At 19:03 Mariano opened the meeting. There was no community input.
2. **COVID-19 community status**
   There were 288 cases in January 2022, 27 cases in February, and 11 cases through March 23rd--there were 4 new cases this week. Fantasia said that McGean's analysis showed that 2 of the recent cases were the BA.2 variant. Over the last 7 days Lincoln had 7 cases, Carlisle had 2 cases and Concord had 38 cases (possibly because of a community event). The BA.2 variant is similar to the original Omicron variant but even more contagious. CDC is now tracking hospitalizations rather than number of cases to inform prevention measures. The State has not produced good guidance on contract tracing. School cases should be reported to the BOH but we can no longer do contact questioning, it is up to individual to notify close contacts. There is a template that the CDC prepared to help individuals decide who they should notify. The template will be added to the town's website.
3. **Town Meeting Planning**
   Wayne Davis, Moderator, is looking for advice on dealing with Covid. The Town Meeting date is late April and unfortunately, we do not know how BA.2 will evolve. Town meeting is a little different from other meetings in that it is important for running our town government and we cannot provide the option of using Zoom and voting remotely. Davis is particularly concerned with ensuring that immunocompromised individuals can safely participate. He is thinking of designating a portion of the auditorium where people can maintain social distance. He will not order people to wear masks. The cafeteria is set up for people with young kids but might also have a section for people to maintain social distance. The use of the cafeteria tends to vary with what is on the warrant and without the pickleball issue he expects there will not be that many families present. Barry suggested that we

might have a larger number of HEPA filters set up. There was some concern that noise could be an issue with HEPA filters, but Galligan said that at least on low speed they are unobtrusive. Davis will check with the new school facilities person about what is available through the school. Barry noted that we should follow CDC guidelines regarding masking. Mariano asked about staggered seating in the auditorium unless the house is packed. Davis does not think it will be too large a crowd because most of the remaining issues are relatively uncontroversial. Davis would not open the divider to the upper level unless there is an uptick in cases. Davis noted that it is important to get information to people before the meeting so they can make an informed decision about participation and protection. The BOH will be meeting on April 6 and probably April 20 so if Covid worsens we can revise plans before the Town Meeting.

4. **Fern's Country Store Public Water Supply Update**
   There has been a concern with water quality. DEP issued a Boil Water Order last summer when e. Coli was detected. At that time Skilling's examined the well and discovered a crack, unfortunately, sealing the crack stopped the flow to the well so a new well is needed--either drilling in place or at a new location. There was a meeting with Matt Herweck, the BOH and DEP to discuss options and to take interim actions to ensure safe operations with weekly testing. Unfortunately, testing has stopped because SWSS has not been paid and no action has occurred in developing a new water source or in properly treating the water. Fantasia spoke with the DEP, and they are concerned that the water supply does not meet public drinking water standards and the lack of effort in addressing the problem. Fantasia reported that Fern's had not properly renewed their permit in January and was operating the deli without a permit. For a food permit, there must be an approved water source. Fantasia spoke with the Town Counsel, and they recommended not issuing a food permit until the water supply is corrected. Since the call to Town Counsel Fern's has submitted an application to renew their food permit and paid SWSS who will resume testing. The latest testing for the store shows no coliform and it has been a while since they detected e. coli, which is why the state lifted the Boil Water Order in December. These problems have been exacerbated because Fern's is leasing the property and the owner had not been paying the bills. Fern's has since paid SWSS directly and they will resume testing and Fern's has made an offer to buy the property, which would mean they could have complete responsibility. Ferns has also reached out to several engineers about designing a water system but have not yet found an engineer willing to take it on.
   After some additional discussion Collins moved to not approve the permit since there is not an approved water source. Galligan seconded the motion, which was then approved by Mariano, Barry, Collins, and Galligan with Erickson abstaining. The Board noted that the Food Service Permit only applies to the Deli. The retail market which only provides commercially prepackaged products can remain open as well as the wine and beer store. The Board is willing to remove the temporary closure as soon as the drinking water source is approved by DEP.
5. **53E revolving Cap**
   We had a very busy year; our revolving account has been capped at $70,000 and as of last week we only had $2,500 to last until June 30. We have submitted a letter to temporarily raise the cap to $100,000 for the remainder of FY22. Expenses were high because Frado had to spend a significant amount of time on Benfield and 15 SDS applications that came in for the Still Meadows development. Gines and Fantasia have been tracking engineering and it has been increasing by about 30%/year. Fantasia spoke with Kimberly Kane, Finance Director, and she suggested a warrant item to raise the cap to $100,000 for FY23. Galligan moved that we seek to raise the cap to $100,000 which was then approved unanimously.
6. **Year-end memo**
   Fantasia sent a memo detailing FY21 activity.
7. **Minutes 3/9/22**
   Galligan moved to approve the 3/9/22 minutes as amended. Collins seconded the motion which was approved unanimously.
8. **Administrative Reports**
   Clean Harbors is increasing their rates by 8-15% but they are cutting back and cannot commit to a date for hazardous waste collection. Costs have increased significantly for transporting waste. Mariano asked about

alternatives and Galligan said that Sudbury uses a different company, Fantasia and Gines are looking into options. There is also the possibility that we could rejoin the Minuteman regional group.
Woodward Village (WV) held a preconstruction meeting with the project manager and installer, Collins has volunteered to be the BOH representative. WV hoped to start next week but needs to pay a second deposit to cover the town's engineering costs for the field work.
See full report below.

9. **Adjourn**
Collins moved to adjourn, seconded, and approved unanimously. Adjourned at 20:31. Next meetings are set for 4/06/22 and 4/20/22
Respectfully submitted,

David Erickson,
Recorder

Meeting Materials

ADMINISTRATIVE REPORTS
March 23, 2022

Hazardous Waste Collection – notice from Clean Harbors on rate increase as of 4/1/22 by 8 – 15%, date of collection TBD

Woodward Village – septic system pre-installation meeting was held 3/16/22; WV invoiced deposit for field work ($4000); hope to start in another week; expected 15-18 build out. Two building permits issued. Additional permits require Fire Dept. approval of the cistern. Inspections will be done on Tues and Th, if possible, to keep Wed open for other Town engineering work.

Public Health Excellence (PHE) Grant - PHE: 0.5 FTE Shared Services Coordinator (Kelli Caeli), 1 FTE Regional Public Health Nurse, 1 FTE Regional Health Inspector, 0.5 FTE PHN, and 1 FTE Community Health Coordinator. CT/CI (Wayland's grant): 0.2 FTE Shared Services Coordinator, 1 FTE Public Health Nurse, 1 FTE Epidemiologist

Benfield Farms – fees paid through January 2022 ($21,225.75); formalizing agreement with CAQ Engineering Associates, Inc. (Carolos Quintal) for FAST System start-up and operations

Garrison Place – Certificate of Compliance released 3/21/22. All conditions satisfied. O&M updated and submitted (hard copy and pdf). Latest testing by SWSS noted high levels of sludge in bioreactor which may be a concern. They will continue to monitor. Monitoring well results could also use BOH review.

Private Well Legislation – statewide code for private wells. Currently the state only has guidelines. Local authorities could have supplementary regulations similar to Title 5. MHOA looking for support.
S.2667, "An Act Promoting Drinking Water Quality for All"

Ongoing Projects

Large Development Compliance
Operations and Maintenance Template
Presentation on PFAs

Select Board
Tuesday, August 31, 2021
Town Hall – Clark Room
66 Westford St., Carlisle, MA 01741

The Carlisle Select Board met on Tuesday, August 31, 2021 at 6:15 p.m. at the Carlisle Town Hall (Clark Room) located at 66 Westford Street. Present were Barney Arnold-Chair, David Model-Vice-chair, Nathan Brown, Kate Reid and Luke Ascolillo.

This meeting was live streamed and recorded: https://www.youtube.com/watch?v=Gwvzvs59zwk

Remote participation: Zoom Meeting / ID: 894 9174 2669
https://us02web.zoom.us/j/89491742669?pwd=bzIxbzF1TVhQQ2NGTk9ySk9DL0tHdz09

Executive Session

On the motion made by Nathan Brown and seconded by Luke Ascolillo, it was unanimously ***VOTED***, that the Select Board enter into executive session pursuant to MGL Ch. 30A, §21(a) paragraph (5) To investigate charges of criminal misconduct or to consider the filing of criminal complaints.

Roll Call Vote: B. Arnold-Aye, L. Ascolillo-Aye, N. Brown-Aye, D. Model-Aye, and K. Reid-Aye.

On the motion made by Nathan Brown and seconded by Luke Ascolillo, it was unanimously VOTED, that the Select Board enter into executive session pursuant to MGL Ch. 30A, §21(a) paragraph (6) to consider the value of real property located at 338 Bedford Road in connection with a gift of an indoor/outdoor pickleball complex as the Chair has declared that an open meeting may have a detrimental effect on the Town's negotiating position and that afterwards the Board will return to open session."

Roll Call Vote: B. Arnold-Aye, L. Ascolillo-Aye, N. Brown-Aye, D. Model-Aye, and K. Reid-Aye.

7:10 PM Chair Barbara Arnold reconvened the meeting of the Select Board in open session.

Community Input: There were no requests.

LEPC Update

7 new covid-19 cases reported in the month of August.

Carlisle remains a low-risk community. The vaccines are working with only a few breakthrough cases in the Town of Carlisle.

Health Agent Linda Fantasia reported that the Department of Public Health has issued a new mask advisory in light of the Centers for Disease Control and Prevention's updated guidance. Fully vaccinated individuals are advised to wear a mask or face covering when indoors outside of your home if you have a weakened immune system, are at increased risk for COVID-19 or if someone in your household is at increased risk or unvaccinated. Masks are still mandatory for all individuals on public and private transportation systems (including rideshares, livery, taxi, ferries, MBTA, Commuter Rail and transportation stations), in healthcare facilities and in other

settings hosting vulnerable populations, such as congregate care settings.

The Board of Health at their meeting held Aug. 25, 2021 passed a motion requiring face masks to be worn Indoors in all public areas. The LEPC voted unanimously to support the mask mandate.

In response to the recent increase in positive COVID-19 cases in Carlisle and throughout Middlesex County, including break-through cases among those who have been fully vaccinated, the Carlisle Board of Health hereby adopts an indoor face mask mandate for all indoor public spaces, or private spaces open to the public within the Town of Carlisle except where an individual is unable to wear a face mask due to a medical condition or disability and in employee's private work space where face masks are encouraged.

On the motion made by Nathan Brown and seconded by Luke Ascolillo, it was unanimously VOTED to support the Board of Health's mask mandate effective September 1, 2021 to require facemasks to be worn indoors in public areas.

This mandate will be revisited by the Select Board and Board of Health in early October, 2021.

Veterans/Celebrations Committee – Proposal to combine committees

The Select Board met with Scott Evans and Christopher Eisenbies to discuss their proposal to combine Celebrations Committee and Veterans Committee.

The Veterans Committee has lacked critical mass of members making it difficult to gain sufficient momentum behind initiated activities to serve our veteran community. The celebrations committee often seeks members with a veteran background and solicits input from the veterans committee when planning Memorial Day. Combining the two organizations will benefit the Celebrations Committee with a more involved and cohesive input from our veteran members, and the Veterans Committee gains the added strength of the Celebrations Committee members in support of existing and planned veteran activities. A combined committee will result in a shared-knowledge of the town needs/activities, and relationships/connections. Aligned goals to celebrate/support/honor worthy civic contributions by individuals and to bring citizens to together for community cohesion and conscientiousness with regards to veterans.

DRAFT CHARGE:

Bring people together, build community awareness, create events, and foster a sense of appreciation around Veterans needs and issues in Carlisle and surrounding communities.

Core/proposed responsibilities and activities of joint committee:

1. Honor Roll maintenance
2. Veterans plaque and area on green
3. Memorial Day event
4. Selection of Honored Citizen
5. Create Carlisle Veterans Day event
6. Quarterly Veterans breakfasts/socials.
7. Initiate biannual school event (e.g. veterans speak with students/classrooms)
8. Participate in regional Sleepy Hollow Veterans Day event.
9. Liaison with Boy/Girl scouts

On the motion made by Nathan Brown and seconded by Kate Reid, it was unanimously ***VOTED*** to combine the Carlisle Celebrations Committee and Veterans Committee to create the Celebrations and Veterans Committee with the following existing members:

Scott Evans,
Laura Mullins
Heidi Haring
Christopher Eisenbies
Greg Fairbanks

It was agreed to schedule a future meeting to review and formally adopt a charter for Celebrations and Veterans Committee Charge.

Personnel Requests

Council on Aging
The Select Board me with COA Director Joan Ingersoll regarding her request for a new Transportation/Office Manager position. COA Transportation and Meals on Wheels Coordinator retired August 26, 2021.

The purpose of this new position is to manage the COA Transportation Program and provide coordination, implementation, and oversight of Meals on Wheels, Volunteer Services, the Senior Tax Worker Program, and other administrative responsibilities required for the efficient and effective operation of the COA. The Transportation and Office Manager is responsible for a set of programs and services that seniors depend on and must be administered with a high level of competence. Transportation is a major component of the COA's services and enables many seniors to attend essential medical appointments and receive ongoing treatment. Meals on Wheels provides nutrition support to homebound seniors who are unable to prepare meals

Transportation and Meals on Wheels Coordinator = $32,760
Outreach and Program Assistant = $15,463
Total Cost = $48,223
LRTA Portion = $20,000

Cost to Town = $28,223

Rationale:

- The COA will function more efficiently with 4 full-time staff
- It makes sense to have the same number of staff members as available workstations, which is 4
- Adding office management responsibilities to the Transportation position does not change the skill sets needed; both are public-facing and require solid organizational and communication skills
- A team of 4 full-time staff enables greater cross training and collaboration across responsibility areas, which provides skill development opportunities for staff and higher quality services for seniors
- This is a cost neutral proposal
- The current Outreach and Program Assistant, who has been trained and provides back-up for transportation and meals on wheels, is interested in the proposed full-time position, enabling the COA to promote a current staff member.

On the motion made by David Model and seconded by Luke Ascolillo, it was unanimously ***VOTED*** to move the request of the COA for a new Transportation/Office Manager position forward to the Personnel Board.

No further action taken by the Select Board at this time.

Continued Discussion - Town of Carlisle Personnel Policie s Revisions

The Select Board met with Town Counsel Donna Brewer to continue reviewing the Town of Carlisle Personnel Policy updates/revisions.

22.0 Holidays

22-1. *Coverage.* Hourly full-time and part-time employees are eligible for holiday compensation. Contract and Temporary employees are not eligible for holiday compensation.

22-2. *Recognized Holidays.* The following holidays shall be recognized by the Town on the day on which they are legally observed by the Commonwealth of Massachusetts, and on these days employees, without loss of pay, shall be excused from all duty except in cases where the appointing authority determines that the employee is required to maintain essential Town services or in the case of the Library where there shall be a floating holiday for the day after Thanksgiving:

New Year's Day	Labor Day
Martin Luther King Day	Columbus Day
Washington's Birthday	Veteran's Day
Patriot's Day	Thanksgiving Day
Memorial Day	Christmas Day
Juneteenth *(To be added)*	Day After Thanksgiving
Independence Day	

As is customary for municipal offices in the Commonwealth of Massachusetts, holidays falling on Sunday are legally observed on the following Monday. Some departments may differ due to public service requirements.

22-3. *Terms of Holiday Pay.* Hourly employees who are scheduled to work on a holiday, or who are requested by their supervisor to work on a holiday, (excluding the Library) shall receive their regular hourly rate in addition to an extra day's pay for the first eight (8) hours and shall be compensated at a one and one-half rate for hours in excess of eight (8) hours, or shall have compensatory time off scheduled by their department head for all holidays worked. For the New Year's Day, Thanksgiving Day, and Christmas Day holidays, employees shall be compensated at a one and one-half hourly rate for all hours worked in addition to an extra day's pay.

Holiday pay shall be granted provided the employee was in full pay status on the regularly scheduled working day preceding and following the holiday in accordance with other provisions of these policies or was officially and appropriately absent.

At its last meeting, the board requested to know the town-wide cost of adding a new holiday (Juneteenth) which is approximately $60K according to the Town Accountant. The Board also expressed the desire not to increase the net number of holidays so in order to add Juneteenth and keep the number the same a current holiday would have to be eliminated.

Note: A follow-up email disclosed that the cost of adding the Juneteenth holiday was less than 60K.

The Board does have the authority to amend the personnel policies; any changes to the holiday in the Police or Dispatch Collective Bargaining Agreements would have to be the subject of collective bargaining.

- Town has observed certain official holidays (Independence Day, Veterans' Day, Christmas and New Years') that occasionally fall on Saturdays on the Friday immediately preceding the holiday and observing Sunday holidays on Mondays.

- The Day After Thanksgiving holiday

[The Select Board unanimously agreed to add the Juneteenth Holiday and not remove any of the existing recognized holidays.]

The Select Board further reviewed Town Counsel language edits

Definitions (1-4)

ADA Coordinator" shall mean the Town Administrator.

[The Board agreed to keep the Town Administrator as the Town's ADA Coordinator]

19. 0 Alcohol and Drug Testing Policy For Employees in Safety-Sensitive Positions
(This policy is based on requirements of the Federal Motor Carrier Safety Administration)

19-5. TESTING

5. Return to Duty and Follow-Up - Return to duty and follow-up drug and alcohol tests are conducted when an individual who has violated the prohibited alcohol or drug standards of this policy, or who has been identified as needing assistance in resolving problems associated with alcohol and/or drug misuse, returns to performing safety-sensitive duties. Follow-up tests are unannounced and at least six (6) tests must be conducted in the first twelve (12) months after a driver returns to duty. Follow-up testing may be extended for up to sixty (60) months [5 years] following the return to duty at the discretion of the employer. The Town will incur the expense of all follow-up tests.

The Town will not pay for the testing of a former employee, for the follow-up testing of any new employee due to a violation as defined by the Department of Transportation while that individual was employed by another employer, or for a second sample test requested by the employee whose result is positive.

***B*. How Tests Are Conducted**

d. Testing is conducted using a two-stage process. First a screening test is performed. If the test is positive for one or more of the drugs, a confirmation test is performed for each identified drug. Sophisticated testing requirements ensure that over-the-counter medications or preparations are not reported as positive results.

[The Select Board agreed to language added by Town Counsel]

24.0 Sick Leave

24-8. *Sick Leave Bank.* Employees who have exhausted their own sick and vacation leave and have a non-work related injury or serious illness may seek to extend paid leave from the sick leave bank.

24.8.1 An employee may apply for up to fifty (50) days of sick leave from the sick leave bank. The leave need not be taken entirely on consecutive days.

24.8.2 An employee who seeks leave from the sick leave bank must provide a written request to the Town Administrator with the following information:

(a) the dates for which the employee anticipates being absent and the date of return to work;
(b) if requesting intermittent leave, the proposed work schedule; and
(c) identification of the nature of the injury or illness, with supporting medical documentation from the employee's treating physician or medical health provider;

[The Select Board agreed that the Sick Leave Bank application shall be approved by the Town Administrator.] with input from Town Accountant and Town Treasurer prior to final approval by the Town Administrator.

26.0 Military Leave

26-1. Coverage. The Town shall comply with the Uniformed Services Employment and Reemployment Act. M embers called to State active duty shall be considered to be on Federal active duty for purposes of this policy.

26-2. Policy. Employees in the Federal or State military reserve forces shall be granted a military leave of absence, for a period not to exceed two (2) weeks for each calendar year. Such employees shall be paid in an amount equal to their normal pay (less the amount paid for military service by the Federal or State government).

The Select Board discussed asking the Town to accept the provisions of G.L. c. 33, § 59. Without knowing the full financial impact, it was agreed to table adding this revised section for Military Leave.

31.0 Small Necessities Leave

31-1. *Policy and Coverage.* Employees who have worked for the Town for at least twelve months and provided at least 1250 hours of service during the twelve months before the leave is requested are eligible.

31-2. *Definitions.*

(a) "Twelve-month period: shall mean "rolling period" measured backward from the date an employee uses any small necessities leave.
(b) "Intermittent leave" shall mean time away from the job taken in separate blocks of time due to a single incident covered by the law.

31-3. *Leave Entitlement.* The Town will provide all eligible employees up to twenty-four (24) hours' unpaid leave in the twelve-month period for any purpose:
Leave may be taken on an intermittent basis, but not in increments of less than one (1) hour.

Employees utilizing leave shall be entitled to be restored to the position held when the leave

commenced or to an equivalent position with equivalent pay, benefits and other terms and conditions of employment.

31-4. *Notice.* If the necessity for leave is foreseeable, the employee shall provide their department head with notice in advance. If the necessity for leave is not foreseeable, the employee shall provide such notice as is practical under the circumstances of the particular case. Where leave is not foreseeable and the employee's notice is verbal, the employee shall complete and submit a written notice as soon as possible.

32.0. Personal Leave

32-1. *Coverage.* Permanent full-time and permanent part-time employees are eligible.

32-2. *Policy for full-time employees.* Full-time employees who have completed the probationary period and who regularly work at least 25 hours a week shall be entitled to sixteen (16) hours for personal leave with pay each fiscal year. Those employees who work regularly at least 20 hours a week but less than 25 hours shall be entitled to paid personal leave on a pro-rated basis.

32.2.1. *Use of Personal Leave.*

(1) Use of personal leave must be approved in advance by the employee's department heads.
(2) Personal leave may be taken in no less than one (1) hour increments.
(3) It is understood that personal leave is to be used to conduct personal business, and is not to be used in lieu of or in connection with holiday or vacation time.

32-3 *Policy for part-time employees. Coverage*. Permanent part-time employees under the Wage & Classification Plan are eligible (*i.e*., Employees working under 20 hours per week on a regularly scheduled basis). Employees working on an "as needed" irregular basis are not eligible.

32.3.1 Policy. Part-time employees working under 20 hours per week who have completed one year of employment shall be entitled to paid Personal Time Off (PTO) hours pro-rated as follows: the average number of weekly hours worked during the prior year, divided by five (5), and multiplied by seven (7).

For example, an employee working an average of 10 hours per week during the prior year shall receive 14 hours of paid PTO in the following fiscal year. An employee averaging 15 hours per week shall receive 21 hours of paid PTO in the next fiscal year.

32.3.2 Use of Paid Personal Leave.

(1) Use of paid personal leave hours must be approved by the employee's department head prior to time taken.
(2) Personal leave hours are available as of July 1 and must be used within that fiscal year.
(3) There is no carry over of hours from year to year.
(4) There is no cash in lieu of personal leave hours.
(5) Personal leave hours may be taken in no less than ½ hour increments.

32-4. *Separation from Employment.*
Accrued but unused personal leave shall not be paid upon separation from employment

[The board also approved Town Counsel's recommendation to remove ~~**36.0 Equal Employment Opportunity**~~ which is already covered in Article 3.0.]

[The board also approved Town counsel's recommendation to remove ~~**37.0 Paid Personal Time Off (PTO)**~~ which

is redundant and just have Personal Leave]

38.0 Social Media Policy.

38-1. Purpose. The Town uses social media, including Town social media sites and accounts, to communicate and interact with the public about official Town business. Consequently, the Town has both an expectation of and a responsibility for the integrity and presentation of its social media content, including information that is attributed to the Town, its Departments, Boards and Committees, and its employees and officials. This policy is adopted to ensure that what is "spoken" on behalf of the Town through social media reflects and conforms with the Town's standards for such content.

This policy shall not be interpreted or applied to prohibit or infringe upon any communication or expression that is protected or privileged under the law, including under state or federal constitutions.

38-2. Definitions. The following definitions shall apply to this policy:

"Social media" is an expansive term that means and includes all digital content posted to the internet, in whatever form. The types of content to which this policy applies include but are not limited to: media sharing (YouTube, Flickr, iTunes); blogging or microblogging (WordPress, Bogger, Twitter); social networking (Facebook, LinkedIn, Ning); shared documents or data sharing repositories (Scribd, SlideShare, Google Docs), social bookmarking (Delicious, Digg, Reddit), and widgets (Google Maps, Addthis, Facebook "Like").

"Town social media" shall mean social media that is created, used, or maintained by the Town for official Town business, distinguishable from social media created, used, or maintained by a Town-affiliated or other person for that person's own personal use.

"Town user" shall mean and include any Town employee or volunteer.

38-3. Creation of Town Social Media. All Town social media requires prior approval before creation or use, in conformance with Section 38-8 of this policy. This includes but is not limited to any general account, departmental account, or individual account for a Town user acting or representing to act in an official Town capacity. As part of the approval process, the IT Department will ensure that any site, account, or other use of such media is properly supported by the IT Department, including through archiving using the Town's Social Media Archive Tool.

38-4. Town Social Media Standards. All Town social media shall be subject to the following standards:

A. The Town may edit the content of or terminate any Town social media at any time without notice.
B. Town social media content shall pertain and be limited to official Town business, including Town-sponsored or Town-endorsed programs, services, and events. No Town user shall express the user's own personal views or concerns using Town social media.
C. Town social media shall adhere to all applicable federal, state, and local laws, regulations, and policies.
D. Town social media content shall be considered a public record. No content that is proprietary, confidential, or not otherwise freely available to the public shall be posted to Town social media.
E. Town users who post or disseminate information on Town social media shall always conduct themselves as professional representatives of the Town. They must follow all applicable Town bylaws, regulations, and policies, including the Public Records Law (*M.G.L.* c.66, §10), State

Ethics Law (*M.G.L.* c.268A) and Financial Disclosure Law (*M.G.L.* c.268B), Open Meeting Law (*M.G.L.* c.30A, §§18-25), and all ethical and non-harassment obligations.

F. Only authorized Town users may post or disseminate information on Town social media, except where Town social media allows for public participation and a Town user participates as a member of the public in that user's personal, not official, capacity. Any such public participation in Town social media by a Town user shall be subject to Section 38-6 of this policy, governing Personal Social Media Use.

G. Town social media shall **NOT** contain:

a. Support, opposition, or other commentaries concerning political campaigns or candidates;
b. Profanity or profane content;
c. Content that promotes, fosters, or perpetuates discrimination based on race, creed, color, age, religion, gender, marital status, veteran status, military services, national origin, physical or mental disability, sexual orientation, gender identity, or any other category protected by federal, state, or local laws;
d. Sexual content or links to sexual content;
e. Solicitations of commerce unrelated to Town business;
f. Unlawful conduct or encouragement of illegal activity;
g. Information that may tend to compromise the safety or security of the public or public systems; or
h. Content that violates a legal ownership interest of any other person; or
i. *Ad hominem* or abusive statements.

38-5. ***Moderation of Public Participation in Town Social Media.*** Town social media may, in certain instances, allow for public participation, including in the form of public comments or messaging with Town employees, officials, departments, boards, or other entities (for example, commenting on a post on the Town's Facebook page). In all instances where the Town's social media provides for public participation, in any form, the Town is creating a **limited public forum**, only. This means that the Town's social media allows for the public to post content solely and only about a specified subject matter and about no other matters. The Town may also restrict public participation in these limited public forums to only certain groups.

The Town may review and moderate public participation content to ensure that it complies with the standards in this policy. No Town user shall modify or delete any public participation content from Town social media without the prior approval of the IT Director or Town Administrator.

Town users shall report any public participation content that contravenes this Policy to the Town Administrator.

38-6. ***Personal Social Media Use.*** Town users who use social media for strictly personal use, outside of the workplace, and not in connection with their official Town duties, do not require approval to do so. However, social media can sometimes blur the line between professional and personal interactions. Therefore, Town users are reminded that this policy must be taken into consideration even for personal social media use, particularly when identifying themselves as employees of the Town or when the context may lead to that conclusion. Town users should use discretion and common sense when employing social media to help prevent inadvertently compromising professional, legal, or ethical standards. Town users should consider the use of a disclaimer, among other actions, when personal social media use could be confused by others to represent an official position of the Town.

Town users should refrain from using social media for personal use while on work time, limiting such use to breaks during normal work hours or off-hours. Town users should also limit personal social media use on Town computers, systems, or other technology and are advised that they have no expectation of privacy when using social media at the workplace, or when using Town computers, systems, or other technology. The Town may access, view, and act upon any information on its computers, systems, or other technology without notice.

Town users shall not disclose any Town-related information that is not already considered public information when using social media for personal use. This rule applies even in circumstances where passwords or other privacy controls are implemented. This policy does not, however, prevent Town users from discussing the terms or conditions of their employment, including any grievance claims or alleged unfair labor practices when using social media for personal use, or otherwise exercising their rights to collective bargaining.

38-7. Retention. All Town social media shall be archived to comply with state and local requirements for document retention. This includes all content removed or deleted from public view~~,~~ under a provision of this policy~~,~~ or for any other reason. No social media content shall be deleted or destroyed without prior approval from the Town Administrator.

38-8. Authorization. All Town users who wish to create, post, maintain, or otherwise use Town social media must be authorized by their supervisor or Appointing Authority to do so. Department heads and other supervisors should discuss any intended use of Town social media with the IT Department, which shall confer and coordinate with the Town Administrator All Town users shall cooperate with the IT Department and Town Administrator concerning the management of Town social media, and comply with their requests including about user accounts and lists, passwords, and other aspects of Town social media.

38-9. Policy Violations. Any Town user who receives information about or becomes aware of a violation of this policy should report the violation to the Town Administrator or IT Director as soon as possible. Non-compliance with this policy may result in any or all the following: (a) Limitation or revocation of individual or department rights to use or participate in Town social media; (b) removal of posts or social media accounts; or (c) corrective or disciplinary actions and sanctions, up to and including termination.

[The Select Board had no objection to the revised language to **38.0 Social Media** as recommended by Town Counsel]

[The Select Board unanimously agreed approve all of Town Counsel's revisions to Personal Policies as discussed tonight and leave out the Military Leave (acceptance of MGL Chapter 33, s.59) which will be discussed at a future meeting.

Appointments/Liaisons

Conservation Restriction Advisory Committee
On the motion made by Kate Reid and seconded by Luke Ascolillo, it was unanimously ***VOTED*** to appoint Lee Tatatistcheff (130 Oak Knoll Road) to serve on the Conservation Restriction Advisory Committee with a term expiring June 30, 2022.

Land Stewardship Committee

On the motion made by Kate Reid and seconded by Luke Ascolillo, it was unanimously ***VOTED*** to appoint Judy Asarkof (362 River Road) to serve on the Land Stewardship Committee with a term expiring June 30, 2022.

Cultural Council
On the motion made by Kate Reid and seconded by Luke Ascolillo, it was unanimously ***VOTED*** to appoint Deborah Bentley (Heald Road) to serve on the Cultural Council with a term expiring June 30, 2024.

FY22 Select Board Goal-setting process Con't.

The Select Board met with Marc Wey to finalize FY2022 Select Board Goals-setting process. Nathan Brown and Marc worked together to summarize the board's long-term and short-term goals as discussed on August 10, 2021.

After reviewing and making final edits it was agreed to formally adopt Fiscal Year 2022 Goals at their next scheduled for Sept 14, 2021.

FINANCIAL SUSTAINABILITY
Ensure Carlisle's long-term affordability for diversity of households.

Short term:

1. Evaluate the expected growth and expenses over the next 5-10 years and develop a plan for addressing the gaps
2. Develop a long-term goal regarding tax increases.

ENVIRONMENTAL SUSTAINABILITY
The Select Board is committed to ensuring the environmental impact is considered for all town projects and purchases. Towards this end, all future decisions should include a description of the environmental impact, whether beneficial or negative, with the goal of promoting beneficial outcomes.

Short term:

1. Create a Town-wide policy and process.
2. Create an environmental sustainability committee charged with specific, measurable action steps.

CITIZEN ENGAGEMENT
An engaged and informed community makes it stronger. We will work to increase interest in town government by ensuring all committees are well structured and supported by the Select Board, and increasing citizens' general involvement in town affairs.

Short term:

1. The Select Board will meet with every committee at least once per year to ensure alignment and communication
2. Committee charter and team reviews
3. Explore methods of outreach regarding opportunities for involvement in town and to increase participation.

QUALITY OF EDUCATION

Ensure our schools remain a strong town asset by providing excellent education pre-K-12 through ensuring a collaborative alignment between the school committees and the Select Board on high level goals for the school districts.

Short Term:

1. Strengthen ties between Town and Schools (CCHS, CPS) at multiple levels through meetings, both to know each other and identify common projects.
2. Work with the school committees to identify a shared vision and long-term goals for education of Carlisle students.

TOWN STAFF ALIGNMENT

Maintain and foster a professional work environment by ensuring collaboration between departments, providing a path for advancement and succession planning, and developing a clear understanding of success through establishing goals and evaluating performance.

Short term:

1. Implement annual goals setting and performance review process at all levels.
2. Meet with staff in a group setting on a quarterly basis to better understand how we can support them.
3. Establish an informal gathering between staff and the Select Board.
4. Create mechanism for celebrating excellence.

Town Administrator's Report

1-Fall Special Town Meeting Discussion

A notice was sent out to all Town departments requesting warrant suggested articles. No requests have been received. At this time, there isn't enough to warrant a Special Town Meeting

- Acceptance of Lion's Gate Road as a Town Way
- Accept fire protection easement – Stillmeadow North, 566 Acton Street
- Acceptance of MGL Chapter 33, s.59 regarding military leave

  This came from the review of the personnel policies with Atty. Brewer. Current policy is for 2 weeks of military leave with the Town paying the difference between the employee's wages and their military pay. Accepting this statute would grant the employee up to 40 pays paid leave for drills/training annually and up to 30 days annually if called up for a state/national emergency, disaster or to repel an insurrection. After the time period passed the town would again only be responsible for the difference in pay rate.

2-Job postings for IT Services Manager and Assistant Treasurer-Collector

The Town has posted the vacant positions of IT Services Manager (new) and Assistant Treasurer-Collector. To date, there has been no response to the IT job posting.

The Board agreed to post job advertisement in the Carlisle Mosquito. In the meantime, It was further agreed to authorize Nathan Brown to meeting the Town's current IT Department to inquire about a higher level of service.

Finance Director is requesting that the Assistant Treasurer-Collector be increased to a full-time 35 hours per

week schedule due to the increased workload in that department.

It was agreed to scheduled the Finance Director Kimberly Kane on the September 14th meeting agenda to discuss her staffing request.

3-Completed CPA project – updated Historic District Map

Updated Historic District Map has been completed for the Town of Carlisle. The Historical Commission by contractor Edgar Stewart to prepared this report which catalogues nearly 50 historical properties within the Carlisle Center Historic district. The finished product is currently posted to the Historical Commission's section of the Town web site.

4_Eversource Delays – CPS Solar Projects

On the motion made by Kate Reid and seconded by David Model, it was unanimously ***VOTED*** to send another letter from the Town of Carlisle regarding continued delays by Eversource on both solar projects and request that additional steps to accelerate progress be taken.

Upcoming Meetings

Tuesday, September 14, 2021
Tuesday, September 28, 2021
Tuesday, October 12, 2021
Tuesday, October 26, 2021

Approval of Minutes/Warrants

On the motion made by Nathan Brown and seconded by Luke Ascolillo, it was *VOTED* [4-0-1] to approve the minutes of July 27, 2021.

The following Town/School Payroll and Expense Warrants were approved by Barney Arnold on 08/17/21:

- Payroll (Town & School) Warrant #1222 ($626,256.38)
- Town Expense Warrant #1322 ($400,384.15)
- School Expense Warrant #1422 ($56,579.17)

On the motion made by Kate Reid and seconded by David Model, it was unanimously ***VOTED*** to adjourn the meeting.

MEETING ADJOURNED

Submitted by:
J. Gibbons

List of documents reviewed at meeting:

- SB Meeting Packet prepared for8/31/2021

Select Board
Tuesday, October 12, 2021
Town Hall – Clark Room
66 Westford St., Carlisle, MA 01741

The Carlisle Select Board met on Tuesday, October 12, 2021, at 7:00 p.m. at the Carlisle Town Hall (Clark Room) located at 66 Westford Street. Present were Barney Arnold-Chair, David Model-Vice-Chair, Kate Reid, David Model, Luke Ascolillo and Nathan Brown.

This meeting was live streamed and recorded: https://www.youtube.com/watch?v=Gwvzvs59zwk

Remote participation was also made available via Zoom Meeting link:
https://us02web.zoom.us/j/89421734129?pwd=SW9pMzB6MXZJR29DR0trZU9IdUdwdz09

Meeting ID: 894 2173 4129 /Passcode: 785968

LEPC update:

Carlisle continues to be a low-risk community.

The Select Board agreed to support the Carlisle Board of Health decision to renew the mandate to wear face masks within buildings with public access.

Halloween Trick-or-Treating - Halloween Trick-or-Treating will take place on Sunday, October 31, 4 to 8 p.m., Carlisle Center. While our masked and costumed youngest citizens normally visit their neighbors on their porches or in their yards, we do ask that if you are showing off your costumes inside a home that you wear a mask.

Public Hearing Continuation: Dangerous Dog hearing

Chair Barney Arnold reconvened the Dangerous [or Nuisance] Dog Hearing pursuant to M.G.L. c.140, §157 and Section 14.6.7 of the Carlisle General Bylaws.

The Carlisle Select Board received a complaint that on 8/20/21, a dog named Beau, Carlisle Dog License Number 865, bit a bicycle rider at Great Brook State Park causing personal injury. The attack occurred at approximately 17:06 hours in an area of Great Brook State Park, 1018 Lowell Street, Carlisle, MA. In accordance M.G.L. c.140, §157 and Section 14.6.7 of the Carlisle General Bylaws, the complaint was investigated by the Carlisle Dog Officer/Animal Control Officer. The Select Board had scheduled a public hearing on the complaint to be held September 28, 2021, at 7:30PM in the Clark Room at the Town Hall, 66 Westford Street, Carlisle, Massachusetts, to investigate the complaint and to determine if remedial measures should be ordered in accordance with state law.

Also present: Town Counsel, Attorney Jennie Merrill, Town of Carlisle Dog Officer/Animal Control Officer Gene Delano, and licensed dog owners Shaunna Simek and David Bokuniewicz.

Select Board chair Barney Arnold informed those present that all testimony will be limited to the issues directly related to the subject matter of the hearing; only one person will be permitted to speak at a time; all discussion will go through the Chair; all parties will be expected to conduct themselves civilly.

Witnesses were asked to raise his/her right hand and swear that "the testimony being provided in this matter is the truth, the whole truth and nothing but the truth."

Dog Owners: Shaunna Simek and David Bokuniewicz
480 South Street, Carlisle, MA

Name of Dog: Beau (Male White dog)
Breed: Dogo Argentino

Chair Barney Arnold established ground rules, informing those present that: testimony will be limited to the issues directly related to the subject matter of the hearing; only one person will be permitted to speak at a time; all discussion will go through the Chair; all parties will be expected to conduct themselves civilly; and argument between parties will not be permitted. Before taking testimony, witnesses must be sworn in. The Chair may ask anyone who intends to testify to stand, raise his/her right hand and swear that "the testimony I am about to give in this matter is the truth, the whole truth and nothing but the truth."

Note: The following testimonies are not verbatim. Online video recording of the meeting is available at https://www.youtube.com/watch?v=Gwvzvs59zwk

Gene Delano, Carlisle Dog Officer: Added a few more facts to his previous statements. “After incident # 1 when I went to serve quarantine notice #1, the owner of the property Shaunna Simek stated to me that the dog involved did not belong to her, that it was her boyfriend’s and had a Billerica address. She stated that at the time of the incident she was upstairs in her home when the little girl from across the street rushed into her home unannounced and was therefore bitten by her dog.

After incident #2, when I went to serve the 2nd quarantine notice, the owner Shaunna Simek stated that the person bitten had been doing work on her property and should not have turned his back on the dog. She again stated that the animal belonged to her boyfriend and that she was trying to get him to be more careful. I issued a Civil Disposition Violation (0280) as a WARNING to Ms. Simek to try to impress upon her the seriousness of a 2nd dog biting incident on her property. I also instructed Ms. Simek to license the dog, as obviously the animal lives at 480 South Street Carlisle, not somewhere in Billerica as she had told me before. On 7/26/21, I contacted Simek by text to let her know her animals were still not licensed in the town. Dog license #865 was issued for Beau on 7/27.

Incident #3 was reported in the Carlisle Mosquito, and I learned about the August 20th mauling at the State Park by reading the online version of the incident. I immediately contacted the CPD and spoke

with Sgt. Mack to inform him that I believed the dog involved in the incident was the Simek dog. Sgt Mack contacted me 1 hour later to tell me that the victim had positively identified the dog and Dave Bokuniewicz as being involved in the incident. I contacted the victim to let him know that the animal was known and had been fully vaccinated against rabies which was the first time the victim was made aware of the vaccination. During the 8 days after the attack on 8/20 I did not receive a call from either the owners of the animal or the CPD to report the need for the 3rd quarantining. I then reached out to Simek again and requested an immediate return call. 5 minutes later I received a call from a person calling himself "Dave" who said he was the owner of the dog and that they intended to rehome the dog due to the incident. I went to serve quarantine notice #3 to Dave Bokuniewicz at the 480 South Street residence where he stated that he, too, had been bleeding after the incident, more than the other guy, and that he had to leave the scene to go to the hospital. I asked where he had been treated and he said he never sought treatment. He then asked if I wanted to see the dog, to which I declined. He stated that the incident wouldn't have happened if the victim hadn't kicked at the dog. I issued Civil Disposition Violation #0281 to Mr. Bokuniewicz for violation of Carlisle Bylaw 14.6.2.4.

Incident #4 was reported to me on or about 9/15 and a subsequent 4th quarantine notice was delivered by the CPD to the residence. I recommend a close and thorough reading of the police reports of record regarding this incident."

During ACO DeLano's testimony, the dog owners repeatedly interrupted him and shouted their disagreements. The Chair warned the dog owners several times to stop their disruptive behavior and that they would have their own opportunity to add testimony.

David Bokuniewicz: (1) Dog Officer has requested the board to read the Police Reports for an incident which involves a worker that trespassed and entered the house without permission and then was bitten. He asked the Board to consider the fact that the Police Report (Incident #4) has a witness statement who is the daughter of owner of the landscape company. (2) Incident #1 was not a dog bite. The young girl was scratched.

Shaunna Simek: Ms. Simek stated that she was not prepared to respond to the written statements read at the initial hearing because she was not given a copy of them in advance. She said that the Dog Officer Gene Delano has never asked her to provide a written statement. She explained that she feels that the hearing process has been one-sided. The board allowed Gene Delano to give additional testimony when they (the dog owners) were told at the end of the last hearing, that no more testimony would be allowed this evening. She feels the Police Report (Incident # 4) lacks important details that would better describe what happened.

Chair Barney Arnold: Read aloud portions of the Police Reports related to Incident #4. When the Chair asked Mr Bokuniewicz if he had asked the victim of incident #4 and/or his relatives to say the injury happened in Lowell (as stated in the police report), Mr. Bokuniewicz said that he did not.

David Bokuniewicz offered testimony: Disputes the witness statements. Says that Shaunna Simek reported the incident to the Police Department immediately after the incident which conflicts with the statements given by the worker and witnesses documented in the Police Report.

Upon the advice of Town Counsel, Barney Arnold listed the documentation and testimony received by the Select Board regarding this matter to include:

1. The Complaint, submitted via email to the Select Board on August 30, 2021.
2. Quarantine Orders dated May 11, 2021, July 11, 2021, August 20, 2021, and September 21, 2021.
3. A Temporary Restraint Order issued by Animal Control Officer Gene F. DeLano on September 8, 2021.
4. Civil Disposition Violations dated July 11, 2021, and August 28, 2021.
5. A written statement, dated September 23, 2021, from the victim of the August 20, 2021 dog bite incident.
6. A written statement, dated September 24, 2021, from the victim of the July 11, 2021 dog bite incident.
7. Incident Reports from the Carlisle Police Department dated August 20, 2021, September 14, 2021 (modified September 15, 2021), and September 16, 2021.
8. A copy of the Notice of the dog hearing sent to the Dog Owners on September 13, 2021.
9. A letter from the Dr. Sarah Tryjankowski, DVM from Nashoba Valley Veterinary Hospital.
10. Photos of the Dog Owners property including: (1) photos of outside fenced in area; (2) photos of several "beware of dog" signs posted on the property; (3) photo of the mud room door; (4) photo of door from the Dog Owners garage to outside; and (5) photos of interior doors and gates.
11. Text exchange and supplemental letter from the Dog Owners.
12. Affidavit from victim Kevin Kelly dated October 6, 2021.
13. Photographs of dog bite and torn pants from Kevin Kelly.
14. Supplemental Statement from ACO DeLano dated October 12, 2021.

- Testimony from Shaunna Simek, provided on 9/28 & 10/12
- Testimony from David Bokuniewicz on 9/28 & 10/12
- Testimony from Carlisle Dog Officer Gene Delano on 9/28 & 10/12
- Testimony from Dog Trainer/Daniel Vigent on 9/28
- Testimony from David Suderman on 9/28
- Testimony from Harry Wright on 9/28

On the motion made by David Model and seconded by Nathan Brown, it was unanimously ***VOTED*** to close the public hearing.

Barney Arnold announced that the Select Board will begin its deliberation and there will be no further testimony or public input.

Town Counsel was requested to review the standards for making the determination of whether a dog is a Nuisance Dog or a Dangerous Dog.

<u>Nuisance Dog</u>

A nuisance dog Is a dog that: (1) by excessive barking or other disturbance, is a source of annoyance to a sick person residing in the vicinity; or (2) by excessive barking, causing damage or other interference, a reasonable person would find such behavior disruptive to one's quiet and peaceful enjoyment; or (3) has threatened or attacked livestock, a domestic animal or a person, but such threat or attack was not a grossly disproportionate reaction under all the circumstances.

The Select Board unanimously agreed that the criteria for a nuisance dog do not apply.

The Board reviewed the definition of a dangerous dog and the exclusions.

Dangerous Dog: M.G.L. c.140, §136A defines "dangerous dog" as:

a dog that either: (i) without justification, attacks a person or domestic animal causing physical injury or death; or (ii) behaves in a manner that a reasonable person would believe poses an unjustified imminent threat of physical injury or death to a person or to a domestic or owned animal.

However, the Board should note that M.G.L. c.140, §157 states that a dog cannot be deemed dangerous:

(i) solely based upon growling or barking or solely growling and barking;

(ii) based on the breed of the dog; or

(iii) if the dog was reacting to another animal or to a person and the dog's reaction was not grossly disproportionate to any of the following circumstances:

1. the dog was protecting or defending itself, its offspring, another domestic animal or a person from attack or assault;

2. the person who was attacked or threatened by the dog was committing a crime upon the person or property of the owner or keeper of the dog;

3. the person attacked or threatened by the dog was engaged in teasing, tormenting, battering, assaulting, injuring or otherwise provoking the dog; or

4. at the time of the attack or threat, the person or animal that was attacked or threatened by the dog had breached an enclosure or structure in which the dog was kept apart from the public.

The Board unanimously agreed that the exclusions did not apply to this dog.

After careful consideration of the testimony and documents received during the hearing, the Chair asked for a motion.

On the motion made by David Model and seconded by Luke Ascolillo, it was unanimously ***VOTED*** to declare the dog (Town of Carlisle Dog License Number 865) to be a Dangerous Dog.

With the assistance of Town Counsel, the Board carefully discussed/reviewed the prescribed remedies under M.G.L. c.140, §157 and Section 14.6.7 that will be required of the dog owners in the Notice of Decision from the Select Board:

1. That the dog be humanely restrained; provided, however, that no order shall provide that a dog deemed dangerous be chained, tethered or otherwise tied to an inanimate object including, but not limited to, a tree, post or building;

2. That the dog be confined to the premises of the keeper of the dog; provided, however, that ''confined'' shall mean securely confined indoors or confined outdoors in a securely enclosed and locked pen or dog run area upon the premises of the owner or keeper; provided further, that such pen or dog run shall have a secure roof and, if such enclosure has no floor secured to the sides thereof, the sides shall be embedded into the ground for not less than 2 feet; and provided further, that within the confines of such pen or dog run, a dog house or proper shelter from the elements shall be provided to protect the dog;

3. That when removed from the premises of the owner or the premises of the person keeping the dog, the dog shall be securely and humanely muzzled and restrained with a chain or other tethering device having a minimum tensile strength of 300 pounds and not exceeding 3 feet in length;

4. That the owner or keeper of the dog provide proof of insurance in an amount not less than $100,000 insuring the owner or keeper against any claim, loss, damage or injury to persons, domestic animals or property resulting from the acts, whether intentional or unintentional, of the dog or proof that reasonable efforts were made to obtain such insurance if a policy has not been issued; provided, however, that if a policy of insurance has been issued, the owner or keeper shall produce such policy upon request of the hearing authority or a justice of the district court; and provided further, that if a policy has not been issued the owner or keeper shall produce proof of efforts to obtain such insurance;

5. That the owner or keeper of the dog provide to the licensing authority or animal control officer or other entity identified in the order, information by which a dog may be identified, throughout its lifetime including, but not limited to, photographs, videos, veterinary examination, tattooing or microchip implantations or a combination of any such methods of identification;

6. That unless an owner or keeper of the dog provides evidence that a veterinarian is of the opinion the dog is unfit for alterations because of a medical condition, the owner or keeper of the dog shall cause the dog to be altered so that the dog shall not be reproductively intact; or

7. That the dog be humanely euthanized.

At this point in the meeting, Chair Barney Arnold asked the dog owners and Select Board member Luke Ascolillo to leave the hearing. This was because 1) throughout the hearing, there were multiple disruptions by dog owners Shaunna Simek and David Bokuniewicz, despite repeated warnings from the Chair to control themselves, and 2) a loud verbal argument between the dog owners and SB member, Luke Ascolillo, erupted at this point and none of the parties responded to the chair's repeated request

to stop. All three left the hearing.

The Board continued their discussion of possible remedies. After lengthy deliberations, on the motion made by David Model and seconded by Nathan Brown, it was unanimously *VOTED* [4-0] to order the following:

1. That the dog be humanely restrained; provided, however, that no order shall provide that a dog deemed dangerous be chained, tethered, or otherwise tied to an inanimate object including, but not limited to, a tree, post or building.

2. That when removed from the premises of the owner or the premises of the person keeping the dog, the dog shall be securely and humanely muzzled and restrained with a chain or other tethering device having a minimum tensile strength of 300 pounds and not exceeding 3 feet in length.

3. That the owner or keeper of the dog provide to the licensing authority or animal control officer or other entity identified in the order, information by which a dog may be identified, throughout its lifetime including, but not limited to, photographs, videos, veterinary examination, tattooing or microchip implantations or a combination of any such methods of identification.

On the motion made by David Model and seconded by Nathan Brown, it was unanimously *VOTED* to authorize the Select Board chair Barney Arnold to sign the Dangerous Dog Decision and official findings of the Select Board.

Public hearing: Grant of location / Eversource

On the motion made by Nathan Brown and seconded by David Model, it was unanimously *VOTED* to continue the public hearing to October 26, 2021, at 7:30PM

Public Hearing: Community Cable Needs Assessment /Comcast

On the motion made by Kate Reid and seconded by David Model, it was unanimously VOTED to close the public hearing for the Community Cable Needs Assessment.

Green Cemetery Fee Structure:

It is Town Counsel opinion that the Select Board should seek Town Meeting approval for any changes to the fees at the Green Cemetery. The Town can set fees at its cemeteries, and the Select Board, acting as Cemetery Commissioners, is empowered to do so by regulation subject to Town Meeting approval.

M.G.L. c. 114, §15, provides in part:

Towns may appropriate money for enclosing any cemetery lawfully provided by them or for

constructing paths and avenues and embellishing the grounds therein, and may establish all necessary rules relative thereto consistent with law. They may lay out such cemetery into lots, and shall set apart a suitable portion as a public burial place for the use of the inhabitants, free of charge. They may sell and convey to any person, resident or non-resident, the exclusive right of burial and of erecting tombs and cenotaphs upon any lot and of ornamenting the same, upon such terms and conditions and subject to such regulations as they shall prescribe….

"Towns" as used in Section 15 implicitly means Town Meeting, and as a result the rules, regulations, and terms of sale contemplated by statute must be approved by Town Meeting before they have force and effect. If the Town has accepted M.G.L. c. 114, §§22-26, establishing a Board of Cemetery Commissioners, the Board has the authority to adopt regulations, including fees, pursuant to Section 23, but these regulations must also be approved by Town Meeting.

Reference to the Select Board as Cemetery Commissioners suggests that the Town has accepted the elective portion of the Chapter 114. This would be consistent with the Town Cemetery Regulations last revised in 2001.

The last page of these Regulations reflects that Town Meeting approval has been obtained for some if not all prior fee changes.

There is one other relevant statutory fee, the local recording fee for a cemetery plot deed, which is set at $1 by M.G.L. c. 262, §34(78). Section 34 provides that this fee may be increased by Town Meeting action adopting a bylaw which prescribes a greater fee.

The Board agreed that a warrant article should be considered for Town Meeting consideration.

Cemetery Deed Transfer Request(s):

Deed 763
On the motion made by Kate Reid and seconded by David Model, it was unanimously ***VOTED*** to transfer land in the public burial ground to Miles King (7 Park St) at Green Cemetery, Lot C18, Grave 1.

Deed 764
On the motion made by Kate Reid and seconded by David Model, it was unanimously ***VOTED*** to transfer land in the public burial ground to Paul & Shirley Nelson (18 Countryside Rd) at Green Cemetery, Lot D329, Graves 1, and 2.

Deed 765
On the motion made by Kate Reid and seconded by David Model, it was unanimously ***VOTED*** to transfer land in the public burial ground to Scott H Seaburg (108 Stow St) at Green Cemetery, Lot C 24, Graves 1, 2, 3 4, 5, 6, 7 and 8.

Deed 766
On the motion made by Kate Reid and seconded by David Model, it was unanimously ***VOTED*** to transfer land in the public burial ground to Kenneth M Deitch (31 Laurelwood Dr) at Green Cemetery, Lot

D172, Graves 1, 2, 3 and 4.

Police Department FY22 Goals

Chief Fisher presented his draft goals for review.

Goal 1: Hire 2 FT Police Officers

- 1st Officer (FY22)
- 2nd Officer (FY23)

The Chief explained that the changes in the Police Reform Act (below) adopted by the Commonwealth mean that he can no longer hire part time officers.

The Select Board asked about funding for the FY22 officer and the Chief responded that he did not think this would require any significant new funds. The Select Board expressed support for hiring a full-time officer this fiscal year. On the FY23 new police officer, the Board and the Chief agreed that this would go through the usual FY23 budget process.

Goal 2: Review, research, draft, and adopt Police Department Policies. The police department members will have guidance required to perform their jobs within the limits of the new laws.

Police Reform Act

- Prioritize policies that may be written with what is known
- Attend meetings and trainings as the Commission provides guidance
- Identify the policies we are going to change
- Obtain policies from exemplary agencies

Re-write 1/3 of the State Accreditation Policies

- Prioritize critical policies and procedures
- Identify which of these we can update now
- Identify the policies we are going to change
- Identify the policies we do not need to adapt
- Obtain policies from exemplary agencies
- Rewrite policies identified using exemplary language specific to Carlisle
- Submit policies for peer review
- Present policy changes to members

Goal 3: Support the Public Safety Facility Task Force to develop a plan to present at Town Meeting

- Meet with stakeholders
- Provide list of needs and liabilities
- Ascertain choice of land
- Define area require for each facility
- Needs Assessment complete for both sides

- Go to bid for design services
- Design presentation for Town Meeting
- Present at Town Meeting

On Goal #3, Nathan Brown suggested that the goal be revised because the Public Safety Facilities Task Force is responsible for the decision about what to recommend to Town Meeting, not Chief Fisher. The Board wants to encourage department heads to submit goals that have the greatest chance of success.

Chief Fisher agreed to submit a revised set of goals.

Fire Department FY22 Goals

Personnel status and trends

- 15 new EMT's, 5 left
- 10 new firefighters, 10 left
- Focus on recruiting and training EMT's since 2019
- Focus on recruiting and training Firefighters in progress
- Recruits who do not own homes are difficult to retain
- Demographics are difficult as the population ages. The population aged 35-45 has greatly decreased over past 30 years
- Headwinds: Demographics, housing costs, station amenities (work space, gathering space, training space)

Demographics

- Affects Recruitment
- Affects equipment needs
- Affects training and retention

Age	1980	1990	2000	2005	2010	2018
0-24	1286	1464	1605	2040	1926	1503
24-40	924	1621	740	476	545	589
40+	1096	1248	2372	2993	3119	3092
Total	3306	4333	4717	5509	5590	5184
40-50	377	70	757	1052	825	637
40-65	909	935	1977	2423	2404	2052
50+	719	1178	1615	1941	2294	2455
>65	187	313	395	570	715	1040

Response to pandemic

- Hired college student and recent graduate EMTs
- Provide staffing for new town needs
- Worked closely with COA and other organizations for their facility needs
- Performed 3000 covid tests, overall 3.11% positive, Currently 6.08%
- Obtained, stored and distributed appropriate PPE Outside funding
- Obtain $100,194.29 Federal AFG grant with 5% Carlisle match

- SCBA compressor in place
- Extrication tools soon
- Obtain $10,000 state grant for safety related equipment
- Rescue boat gift of Maynard Fire Department
- Scott SCBA packs and bottles gift of neighboring departments
- Previous grant for Gear washers

Fire Department received a FEMA grant in the amount of $100K from the Assistance to Firefighter federal grant program (FEMA). The funds were used to purchase SCBA compressor and extrication tools.

Goal 1: NFIRS compliant reporting system

- Currently only doing minimum reporting required by law
- Required for grant funding
- Needed for grant applications, ISO ratings, exposure tracking etc
- Cloud based system will cost money
- Will be locked in, once chosen do not want to change
- Ability to integrate into current systems, integration costs
- Retaining ownership of the data

Note: Remaining FEMA grant funds will be used for the NFIRS system

Goal 2: Obtain UTV outfitted for off road medical response

- Older and smaller EMTs medically capable but more prone to injury with long carries
- More use of open space by population
- Also used for brush fires
- Outfitted for response in snow (cross country ski injuries

Goal 3: Recruit and train firefighters

- Daytime coverage an issue
- EMS had been the priority previously
- Goal of opportunity
- Training difficult as we lose experienced people
- Demographics and housing are severe headwinds

Appointments/Resignations:

Master Plan Steering Committee

On the motion made by Kate Reid and seconded by David Model, it was ***VOTED*** to support the Planning Board appointment of Christina Christodoulopoulos (Hemlock Hill) to the Master Plan Steering Committee.

Conservation Restriction Advisory Committee

On the motion made by Kate Reid and seconded by David Model, it was *VOTED* to appoint Jeannie

Geneczko (Maple Street) to serve on the Conservation Restriction Advisory Committee for a term that will expire June 30,2022.

Town Administrator's Report:

Comcast Cable license extension

The Town has contacted the Dept. of Telecommunications regarding a 6-month extension of Carlisle's cable television license agreement with Comcast while the Select Board continues to negotiate with Comcast for a new agreement. Dept. of Telecommunications routinely grants such extension requests, but procedurally, they require the Town to formally reject Comcast's initial proposal to continue negotiating.

On the motion made by Kate Reid and seconded by David Model, it was *VOTED* to preliminarily deny Comcast's renewal license proposal to allow more time to come to an agreement with Comcast, and to direct Town Counsel to move for a 120-day extension of time for filing of the written reasons for the preliminary denial so that the parties may continue to finalize the terms of renewal.

Extension of initial reporting requirement for ARPA

The first formal report on the use of the federal ARPA funds had been October 31st but the federal government has extended that deadline to next April 1st, which now lines up well with the budgeting/Town Meeting.

Traffic & Pedestrian Safety Committee (TPSC) Update:

TPSC met to consider some of the concerns raised by residents regarding the traffic signage in Carlisle Center as a part of the Complete Streets project.

The Committee did not have much input into this issue at the time since the project was State funded and on a State numbered route. TPSC ultimately decided to seek a meeting with MassDOT regarding what options, if any, there are for rural communities such as Carlisle. The signs can be smaller in diameter. However, the color, number of signs and the placement may not be and require more discussion.

Eversource approval of Ameresco Solar panel interconnection

Eversource has approved the interconnection application for Ameresco Solar, and the panels are now energized and producing energy (and revenues). A letter from Ryan Fahey/Ameresco thanked Carlisle officials and residents who helped move this project across the finish line.

Offer to new Assistant Treasurer-Collector

After re-advertising a full-time 35 hour per week position, the Finance Director and Town Administrator are recommending that the Board hire Tara Bicknell of Chelmsford, MA as Assistant Treasurer-Collector. Tara has a good deal of experience in financial positions and most recently has worked in the Finance Dept. for the Town of Acton. Additionally, she has attended the certification school for financial officials at UMass-Amherst and her references were all very positive. She has been CORI

checked and the Town is in the process of the requisite credit check.

Approval of Minutes/Warrants:

On the motion made by Kate Reid and seconded by David Model, it was ***VOTED*** to approve the minutes of September 14, 2021, as presented.

The following Town/School Payroll and Expense Warrants were approved by Barney Arnold on:

09/29/21:

- Payroll (Town & School) Warrant #2222 ($760,085.55)
- Town Expense Warrant #2322 ($869623.88)
- School Expense Warrant #2422 ($46,395.34)

On the motion made by Kate Reid and seconded by David Model, it was unanimously ***VOTED*** to adjourn the meeting.

Meeting adjourned.

List of documents reviewed at meeting:

1. Meeting Packet prepared for 9/28/21
2. The Complaint, submitted via email to the Select Board on August 30, 2021.
3. Quarantine Orders dated May 11, 2021, July 11, 2021, August 20, 2021, and September 21, 2021.
4. A Temporary Restraint Order issued by Animal Control Officer Gene F. DeLano on Sept 8, 2021.
5. Civil Disposition Violations dated July 11, 2021 and August 28, 2021.
6. A written statement, dated Sept 23, 2021, from the victim of the Aug 20, 2021 dog bite incident.
7. A written statement, dated Sept 24, 2021, from the victim of the July 11, 2021 dog bite incident.
8. Incident Reports from the Carlisle Police Department dated Aug 20, 2021, Sept 14, 2021 (modified Sept 15, 2021), and September 16, 2021.
9. A copy of the Notice of the dog hearing sent to the Dog Owners on Sept 13, 2021.
10. A letter from the Dr. Sarah Tryjankowski, DVM from Nashoba Valley Veterinary Hospital.
11. Photos of the Dog Owners property including: (1) photos of outside fenced in area; (2) photos of several "beware of dog" signs posted on the property; (3) photo of the mud room door; (4) photo of door from the Dog Owners garage to outside; and (5) photos of interior doors and gates.
12. Text exchange and supplemental letter from the Dog Owners.
13. Affidavit from Kevin Kelly dated Oct 6, 2021.
14. Photographs of dog bite and torn pants from Kevin Kelly.
15. Supplemental Statement from ACO DeLano dated Oct 12, 2021.

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521
boardofhealth@carlislema.gov

Message from the Carlisle Board of Health Chairman:

During this difficult time of global pandemic, the Carlisle Board of Health is working diligently to minimize the impact of COVID-19 on our town, while still addressing routine public health issues.
Throughout this crisis, we are doing our best to support our public health duties related to land use permitting. Be assured that all requests are being received and will be addressed as soon as possible.

Please keep the following in mind:

- The Board of Health's current priority is COVID-19 response activities.
- Staff is working remotely as much as possible in keeping with the Governor's Orders. Messages to the Health Department—whether by phone, email, or US Mail—are monitored on a regular and frequent schedule.
- In conjunction with addressing COVID-19 issues, high priority is given to emergency needs that may pose a risk to public health, such as failed septic systems.
- Health Department activities are triaged to most effectively use our department's resources. You can help insure that we support you in a timely and efficient manner by doing the following:
    - Be patient and be polite to our staff. They have been working long unpredictable hours to keep you safe, and your courtesy goes a long way to prevent their burnout.
    - Submit requests as early as possible. Requests are generally addressed first-come first-served. The terser and more clear your request, the more quickly it can be handled.
    - If you are submitting applications, make sure that they are complete. Incomplete applications will be given low priority for response.

Thank you for your continued support as we work to safely reopen our community. If you have any questions or concerns, don't hesitate to reach out to me.

Tony Mariano

_____

Tony Mariano
Chairman, Carlisle Board of Health
August 12, 2020

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

MEMORANDUM

To: Carlisle Select Board
Town Administrator
Town Counsel
From: Carlisle Board of Health
Tony Mariano, Chairman
Date: August 26, 2021

In Re: Town of Carlisle Face Mask Mandate

Acting under its authority stated in Mass. General Laws, Chapter III, Section 31, the Carlisle Board of Health at a duly posted public meeting held on August 25, 2021, unanimously voted as follows:

> In response to the recent increase in positive COVID-19 cases in Carlisle and throughout Middlesex County, including break-through cases among those who have been fully vaccinated, the Carlisle Board of Health hereby adopts an indoor face mask mandate for all indoor public spaces, or private spaces open to the public within the Town of Carlisle except where an individual is unable to wear a face mask due to a medical condition or disability and in employee's private work space where face masks are encouraged. This mandate will be revisited by the Board of Health in early October, 2021.

Massachusetts General Laws Chapter 111, Section 104 permits "the selectmen and the board of health [to] use all possible care to prevent the spread of [an] infection" that is dangerous to public health. The Board of Health therefor requests that the Carlisle Select Board also issue an emergency declaration for the implementation of a local face mask mandate within the Town of Carlisle.[1]

[1] *See* Massachusetts General Laws Chapter 111, Sections 31 and 104

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

MEMORANDUM

To: Carlisle Select Board
Town Administrator
Town Counsel
From: Carlisle Board of Health
Tony Mariano, Chairman
Date: October 12, 2021

In Re: Town of Carlisle Face Mask Mandate

At a public meeting held on October 6, 2021, the Carlisle Board of Health revisited the Face Mask Mandate for all indoor public spaces or private spaces open to the public within the Town of Carlisle as previously planned. The Board of Health unanimously voted to continue the Face Mask Mandate and reconsider the mandate in early November. The Board of Health recommends that the Select Board take the same position.

The reasons for this recommendation are:

- The Board felt that the initial Face Mask Mandate was well timed and may have contributed to the continuing low number of COVID cases in Carlisle.
- The Board feels it would be prudent to parallel the state guidance in effect on the school campus
- The Board does not want to engage in constantly changing positions on face masks which would be confusing to residents and visitors.
- The Board will revisit the Face Mask Mandate again in early November which may also coincide with new guidance for the school.

Town of Carlisle
Office of
BOARD OF HEALTH
66 Westford Street
Carlisle, MA 01741

Tel.: (978) 369-0283
Fax: (978) 369-4521

MEMORANDUM

To:	Carlisle Select Board Town Administrator Town Counsel
From:	Carlisle Board of Health Linda Fantasia, Health Agent
Date:	November 18, 2021
In Re:	Town of Carlisle Face Mask Mandate

At a public meeting held on November 17, 2021, the Carlisle Board of Health revisited the Face Mask Mandate for all indoor public spaces or private spaces open to the public within the Town of Carlisle as previously planned. The Board of Health voted to continue the Face Mask Mandate and to reconsider the mandate in early December. The Board of Health recommends that the Select Board take the same position.

The reasons for this recommendation are:

- Carlisle has an 83% vaccination rate among eligible residents
- While the vaccines are reducing the risk of severe illness, there has been a rise in the state positivity rate; this was not unexpected but remains a concern
- Middlesex County is still listed as high risk on the state data chart
- There have been some breakthrough cases (1.3%) of fully vaccinated individuals in the state
- Vaccinations for ages 5-11 are only starting so this population is not yet fully vaccinated
- Holiday gatherings and travel may present additional risks
- The Board will revisit the Face Mask Mandate again in early December.

The Board did approve one exception to the mandate for activities in which the performer and/or officiant, if fully vaccinated, may remove his/her mask for the purpose of performing but must put the mask back in place when not performing.

Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Travel Medicine and Infectious Disease 36 (2020) 101751

Contents lists available at ScienceDirect

Travel Medicine and Infectious Disease

journal homepage: www.elsevier.com/locate/tmaid

Efficacy of face mask in preventing respiratory virus transmission: A systematic review and meta-analysis

Mingming Liang[a,b,1], Liang Gao[c,1], Ce Cheng[d], Qin Zhou[e], John Patrick Uy[f], Kurt Heiner[g], Chenyu Sun[f,*]

[a] Department of Epidemiology and Health Statistics, School of Public Health, Anhui Medical University, Hefei, 230032, Anhui, PR China
[b] Center for Evidence-Based Practice, Anhui Medical University, Hefei, 230032, Anhui, PR China
[c] Center of Experimental Orthopaedics, Saarland University Medical Center, Kirrberger Straße Building 37-38, D-66421, Homburg, Saar, Germany
[d] Department of Internal Medicine, Cape Fear Valley Medical Center, Fayetteville, 28304, NC, USA
[e] Mayo Clinic, Rochester, MN, 55905, USA
[f] AMITA Health Saint Joseph Hospital Chicago, Chicago, 60657, Illinois, USA
[g] Dignity Health Mercy Hospital, Merced, 95340, CA, USA

ARTICLE INFO

Keywords:
Facemask
Respiratory virus
Influenza
SARS-CoV
SARS-CoV-2
Prevention

ABSTRACT

Background: Conflicting recommendations exist related to whether masks have a protective effect on the spread of respiratory viruses.

Methods: The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement was consulted to report this systematic review. Relevant articles were retrieved from PubMed, Web of Science, ScienceDirect, Cochrane Library, and Chinese National Knowledge Infrastructure (CNKI), VIP (Chinese) database.

Results: A total of 21 studies met our inclusion criteria. Meta-analyses suggest that mask use provided a significant protective effect (OR = 0.35 and 95% CI = 0.24–0.51). Use of masks by healthcare workers (HCWs) and non-healthcare workers (Non-HCWs) can reduce the risk of respiratory virus infection by 80% (OR = 0.20, 95% CI = 0.11–0.37) and 47% (OR = 0.53, 95% CI = 0.36–0.79). The protective effect of wearing masks in Asia (OR = 0.31) appeared to be higher than that of Western countries (OR = 0.45). Masks had a protective effect against influenza viruses (OR = 0.55), SARS (OR = 0.26), and SARS-CoV-2 (OR = 0.04). In the subgroups based on different study designs, protective effects of wearing mask were significant in cluster randomized trials and observational studies.

Conclusions: This study adds additional evidence of the enhanced protective value of masks, we stress that the use masks serve as an adjunctive method regarding the COVID-19 outbreak.

1. Introduction

Facemasks are recommended for diseases transmitted through droplets and respirators for respiratory aerosols, yet recommendations and terminology vary between guidelines. The concepts of droplet and airborne transmission that are entrenched in clinical practice recently are more complex than previously thought. The concern is now increasing in the face of the Coronavirus Disease 2019 (COVID-19) pandemic [1]. The spread of respiratory viral infections (RVIs) occurs primarily through contact and droplet routes. And new evidence suggests severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) can remain viable and infectious in aerosols for hours [2]. Therefore, the use of masks as appropriate personal protective equipment (PPE) is often considered when preventing the spread of respiratory infections. Experimental data shows that the micropores of mask block dust particles or pathogens that are larger than the size of micropores [3]. For example, the micropores of N95 masks materials are only 8 μm in diameter, which can effectively prevent the penetration of virions [4,5].

Although the aforementioned studies support the potential beneficial effect of masks, the substantial impact of masks on the spread of laboratory-diagnosed respiratory viruses remains controversial [6]. Smith et al. indicated that there were insufficient data to determine definitively whether N95 masks are superior to surgical masks in protecting healthcare workers (HCWs) against transmissible acute

* Corresponding author. AMITA Health Saint Joseph Hospital Chicago, 2900 N. Lake Shore Drive, Chicago, 60657, Illinois, USA.
E-mail address: drsunchenyu@yeah.net (C. Sun).
[1] These authors contributed equally: Mingming Liang and Liang Gao.

https://doi.org/10.1016/j.tmaid.2020.101751
Received 31 March 2020; Received in revised form 16 May 2020; Accepted 20 May 2020
Available online 28 May 2020
1477-8939/

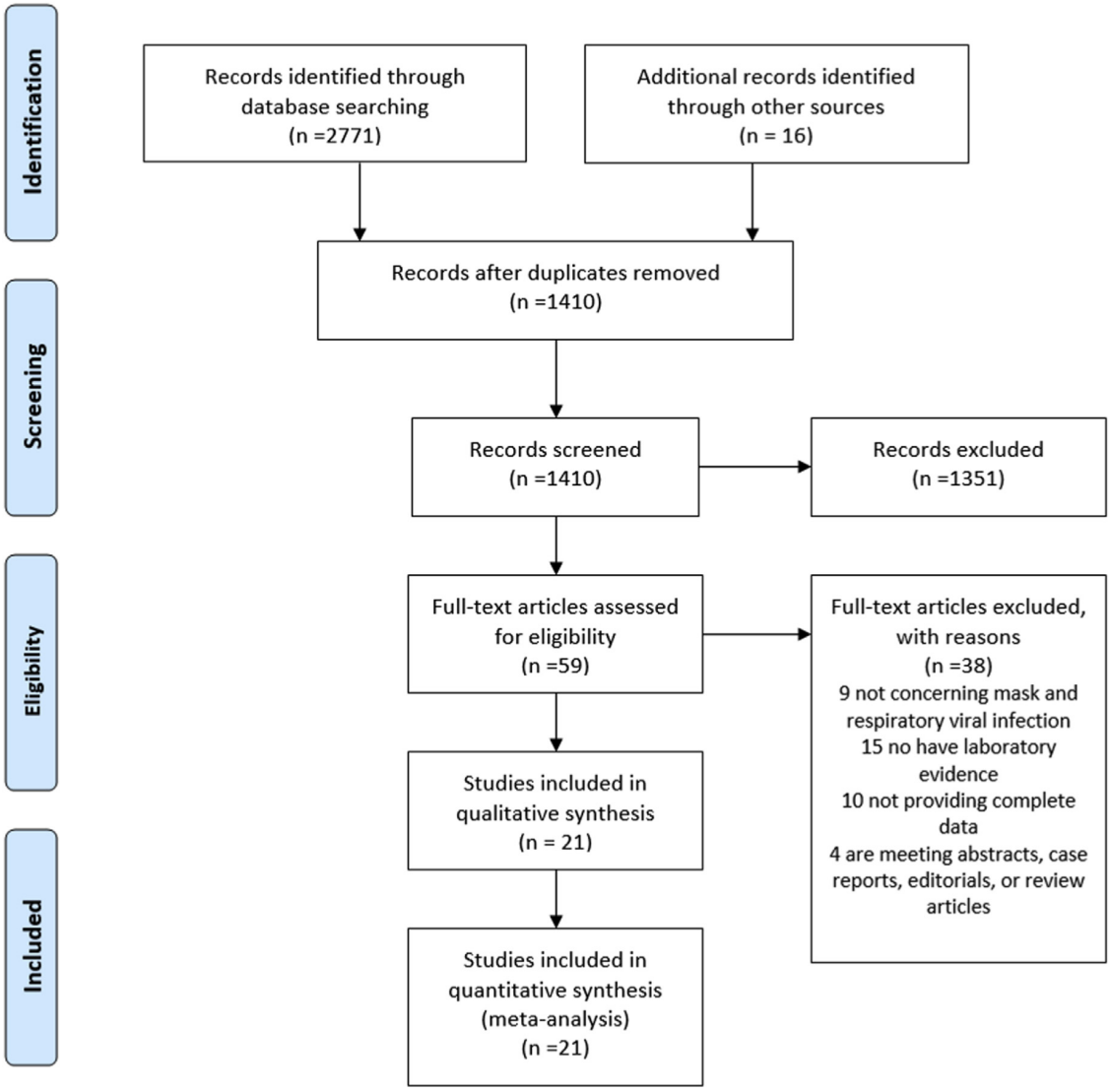


Fig. 1. Flow diagram of the study search and selection process.

respiratory infections in clinical settings [7]. Another meta-analysis suggested that facemask provides a non-significant protective effect (OR = 0.53, 95% CI 0.16–1.71, I^2 = 48%) against the 2009 influenza pandemic [8]. Xiao et al. concluded that masks did not support a substantial effect on the transmission of influenza from 7 studies [6]. On the contrary, Jefferson et al. suggested that wearing masks significantly decreased the spread of SARS (OR = 0.32; 95% CI 0.25–0.40; I^2 = 58.4%) [9]. Up to date, existing evidence on the effectiveness of the use of masks to prevent respiratory viral transmission contradicts each other.

Therefore, we performed a systematic review and meta-analysis to evaluate the effectiveness of the use of masks to prevent laboratory-confirmed respiratory virus transmission.

2. Methods

2.1. Identification and selection of studies

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement was consulted to report this systematic review. A comprehensive searching strategy was carefully designed to select eligible studies, published before March 2020, from multiple electronic databases, including PubMed, Web of Science, Cochrane Library, and Chinese National Knowledge Infrastructure (CNKI), VIP (Chinese) database. Relevant Chinese technical terms for the Chinese databases were used to search for published articles (see Appendix 1, for search details). Furthermore, references of all relevant articles and reviews were retrieved to search for additional eligible studies with full-texts. After removing duplicates, all abstracts and titles were filtered independently by two reviewers (M.L.; L.G.) and the full texts were downloaded and meticulously appreciated. The two reviewers compared and discussed the results and consulted with the third reviewer (C.Y.S.), if necessary, to reach a consensus.

2.2. Inclusion and exclusion criteria

The studies meeting the following criteria were included: (1) concerning the relationship between the face mask and preventing RVIs; (2) diagnosis of respiratory virus must have laboratory evidence, or the local clinical diagnostic criteria are applied during an acute large-scale infectious disease when laboratory evidence might be not available; (3) complete data available of both cases and controls to calculate an odds

ratio (OR) with 95% confidence interval (CI); (4) appropriate study design; (5) no language restrictions applied. The exclusive criteria were as follows: (1) conferences/meetings abstracts, case reports, editorials, and review articles; (2) duplicate publication or overlapping studies; (3) studies with unavailable full texts.

2.3. Study quality assessment

The Newcastle-Ottawa Scale (NOS) was used to evaluate the quality of the case-control study and cohort study: study ratings of seven to nine stars corresponded to high-quality, five to six stars to moderate quality, and four stars or less to low quality [10]. The Jadad scale was used to evaluate the quality of randomized controlled study: study ratings of three to five corresponded to high-quality, and two or less to low quality [11]. Three reviewers (M.L.; L.G.; C.Y.S.) completed assessments independently and the disagreements were resolved by a panel discussion with other reviewers.

2.4. Statistical analysis

The association of mask use with subsequent RVIs was assessed with odds ratios (ORs) with a 95% confidence interval (CI). P values less than 0.05 were considered statistically significant. Considering the potential for inter-study heterogeneity, subgroup analysis were carried out based on stratification by occupations (HCWs or Non-HCWs), countries, virus types, and study designs. Sensitivity analysis was performed by omitting individual studies to assess the stability of the meta-analysis. The heterogeneity was assessed using the I^2 statistic. The heterogeneity was considered insignificance when $P > 0.10$ and $I^2 < 50\%$. If the study lacked heterogeneity, the pooled OR estimate was calculated using the fixed-effects model, otherwise the random-effects model was used [12]. Begg's and Egger's test were performed to quantitatively analyze the potential publication bias by Stata (version 14.0; Stata Corp, College Station, TX) software. The P values of Begg's and Egger's test more than 0.05 implied no obvious publication bias in this meta-analysis [13,14]. The meta-analysis was performed using Revman 5.3.5 (http://tech.cochrane.org/revman) [15].

3. Results

3.1. Characteristics of eligible studies

Following the literature search and screening (Fig. 1), a total of 21 studies which included 13 case-control studies, 6 cluster randomized trials, and 2 cohort studies met our inclusion criteria [4,16–35] (Table 1). Among them, 12 studies investigated HCWs, 8 studies investigated non-healthcare professional populations, and the remaining one study investigated HCWs and relatives of patients. Eleven studies were conducted in China (including 4 studies from Hong Kong, China), 6 in Western countries, and 4 in other Asian countries. And 4 studies investigated patients with respiratory virus, 7 studies investigated Severe acute respiratory syndrome coronavirus (SARS-CoV), 12 studies investigated influenza virus including 5 investigating the H1N1 virus, and 1 study investigated SARS-CoV-2.

3.2. Quality of studies

Inter-rater agreement of the quality of included studies was strong. Tables 2 and 3 summarize the quality evaluations of the included studies. Funnel plots assessing the risk of publication bias are included in Fig. 2. Neither Begg's test (z = 0.45, p = 0.651) nor Egger's test (t = −0.65, p = 0.524) manifested any distinct evidence of the publication bias. The sensitivity analyses did not substantially alter the pooled ORs by excluding one-by-one study, indicating that the meta-analysis was generally robust.

3.3. General protective effects

The 21 studies, involving 8,686 participants, showed that masks were generally effective in preventing the spread of respiratory viruses. After wearing a mask, the risk of contracting RVIs was significantly reduced, with the pooled OR was 0.35 and 95% CI = 0.24–0.51 (I^2 = 60%, M − H Random-effect model) (Fig. 3).

3.4. HCWs vs. non-HCWs

In the subgroup of HCWs, a more obvious protective effect was identified with the pooled OR of 0.20 (95% CI = 0.11–0.37, I^2 = 59%) (Fig. 4). In one study investigating COVID-19, the OR was 0.04 (95%CI = 0.00–0.60) [35]. In the subgroup of non-HCW, also a protective effect was found with the pooled OR of 0.53 (95% CI = 0.36–0.79, I^2 = 45%). A more detailed analysis found significant effects in both the household subgroup (OR = 0.60, 95% CI = 0.37–0.97,I^2 = 31%), and the non-household subgroup (OR = 0.44, 95% CI = 0.33–0.59,I^2 = 54%) (Table 4). One study included both health care workers and family members of patients, with the OR of 0.74 (95% CI: 0.29–1.90) [22].

3.5. Asian countries vs. Western countries

By geographic locations, beneficial protective effects of wearing masks were found both in Asia (OR = 0.31, 95% CI = 0.19–0.50, I^2 = 65%), and in Western countries (OR = 0.45, 95% CI = 0.24–0.83, I^2 = 51%) (Table 4). For HCWs, wearing mask can significantly reduce the risk of RVIs in both Asian (OR = 0.21, 95% CI = 0.11–0.41, I^2 = 64%) and Western countries (OR = 0.11, 95% CI = 0.02–0.51, I^2 = 0%). For non-HCWs, similar protective effects were also observed in Asian (OR = 0.51, 95% CI = 0.34–0.78, I^2 = 45%) and Western countries (OR = 0.46, 95% CI = 0.34–0.63, I^2 = 57%).

3.6. Subgroup analyses based on different virus types

Masks had a protective effect against influenza viruses (OR = 0.55, 95% CI = 0.39–0.76, I^2 = 27%), SARS (OR = 0.26, 95% CI = 0.18–0.37, I^2 = 47%), and SARS-CoV-2 (OR = 0.04, 95% CI = 0.00–0.6, I^2 = 0%) (Table 4). However, no significant protective effects against H1N1 was shown (OR = 0.30, 95% CI = 0.08–1.16, I^2 = 51%).

3.7. Subgroup analyses based on different study designs

In the subgroups based on different study designs, protective effects of wearing mask were significant in cluster randomized trials (OR = 0.65, 95% CI = 0.47–0.91, I^2 = 20%) and observational studies (OR = 0.24, 95% CI = 0.15–0.38, I^2 = 54%) (Table 4).

4. Discussion

This meta-analysis of the 21 studies provided the latest state-of-art evidence on the efficacy of masks in preventing the transmission of RVIs. Our data show that the protective effects of masks against RVIs were not only significant for both HCWs and non-HCWs, but also consistent between Asian and Western populations.

4.1. Mechanism of physical protection of masks

The physical barrier provided by a mask can effectively prevent the respiratory tract from contacting the outside virus, thereby reducing the risk of respiratory virus infections [36]. A recent study showed that SARS-CoV-2 can travel up to 4 m (≈13 feet) from patients and be widely distributed on daily objects (e.g. floors, computer mice, trash cans) [37]. Surgical masks are able to reduce influenza virus RNA in

Table 1
Characteristics of eligible studies.

	Study	Year	Country	Virus	Mask type	Type of Study	Population	Main findings & comments
1	Yin et al.	2004	China	SARS[a]	Paper mask, cotton mask	Case-control study	Healthcare workers	Wearing a mask is effective for medical personnel in preventing SARS hospital infections.
2	Wu et al.	2004	China	SARS[a]	Mask	Case-control study	Population	The mask use lowered the risk for disease supports the community's use of this strategy
3	Ma et al.	2004	China	SARS[a]	Mask	Case-control study	Healthcare workers	Wearing masks is of great significance to prevent respiratory infections. There are many types of masks used clinically.
4	Loeb et al.	2004	Canada	SARS	Medical Mask, N95	Case-control study	Healthcare workers	Consistently wearing a mask (either surgical or particulate respirator type N95) while caring for a SARS patient was protective for the nurses.
5	Teleman et al.	2004	Singapore	SARS[a]	N95	Case-control study	Healthcare workers	Both hand washing and wearing of N95 masks remained strongly protective but gowns and gloves did not affect.
6	Nishiura et al.	2005	Vietnam	SARS	Surgical mask	Case-control study	Employees and relative	Masks and gowns appeared to prevent SARS transmission.
7	Wilder-Smith et al.	2005	Singapore	SARS	N95	Case-control study	Healthcare workers	Asymptomatic SARS was associated with lower SARS antibody titers and higher use of masks when compared to pneumonic SARS.
8	MacIntyre et al.	2011	China	Respiratory virus	Medical Mask, N95 Fit tested, N95 non-fit tested	Cluster randomized trial	Healthcare workers	There was no significant difference in outcomes between the N95 arms with and without fit testing.
9	Barasheed et al.	2014	Australia	Respiratory virus	Mask	Cluster randomized trial	Pilgrims	The laboratory results did not show any difference between the 'mask' group and 'control' group.
10	Sung et al.	2016	USA	Respiratory virus	Mask	Cohort study	HSCT patients	The requirement that all individuals in direct contact with HSCT patients wear surgical masks will reduce RVI.
11	Zhang et al.	2017	China	Respiratory virus	Masks	Case-control study	Healthcare workers	Choosing the right disposable respirator also plays an important role in controlling hospital viral infections.
12	Cowling et al.	2008	China (Hong Kong)	Influenza virus	Mask	Cluster randomized trial	Household	The laboratory-based or clinical secondary attack ratios did not significantly differ across the mask group and control group. Adherence to interventions was variable.
13	Cowling et al.	2009	China (Hong Kong)	Influenza virus	Mask	Cluster randomized trial	Household	Hand hygiene and facemasks seemed to prevent household transmission of influenza virus when implemented within 36 h of index patient symptom onset.
14	Suess et al.	2012	Germany	Influenza virus	Mask	Cluster randomized trial	Household	The secondary infection in the mask groups was significantly lower compared to the control group.
15	Aiello et al.	2012	USA	Influenza virus	Mask	Cluster randomized trial	Student	Face masks and hand hygiene combined may reduce the rate of ILI and confirmed influenza in community settings.
16	Cheng et al.	2010	China (Hong Kong)	H1N1	Surgical mask	Case-control study	Healthcare workers	Not wearing a surgical mask during contact with the index case were found to be significant risk factors for nosocomial acquisition of S-OIV.
17	Jaeger et al.	2011	USA	H1N1	Mask or N95	Cohort study	Healthcare workers	The use of a mask or N95 respirator was associated with remaining seronegative.
18	Chokephaibulkit et al.	2012	Thailand	H1N1	Mask	Case-control study	Healthcare workers	During the H1N1 outbreak in 2009, the wearing of masks by medical personnel was not related to the infection. There was a weak association in the nurse subgroup.
19	Zhang et al.	2012	China	H1N1	Mask	Case-control study	Healthcare workers	The results suggest that the protective effect of wearing a mask is not significant.
20	Zhang et al.	2013	China (Hong Kong)	H1N1	Mask	Case-control study	Population	Wearing masks is a protective factor against H1N1 infection when taking a plane.
21	Wang et al.	2020	China	SARS-CoV-2	N95	Case-control study	Healthcare workers	The 2019-nCoV infection rate for medical staff was significantly increased in the no-mask group compared with the N95 respirator group (adjusted odds ratio (OR): 464.82, [95% CI: 97.73-infinite]).

[a] Patients met local clinical diagnostic criteria during an acute large-scale infectious disease.

Table 2
The quality of the case-control studies and cohort studies.

	Study	Year	Selection	Comparability	Outcome	Stars[a]
1	Yin et al.	2004	3	2	2	7
2	Wu et al.	2004	4	2	2	8
3	Ma et al.	2004	3	2	2	8
4	Loeb et al.	2004	3	2	2	7
5	Teleman et al.	2004	3	2	3	8
6	Wilder-Smith et al.	2005	3	2	3	8
7	Nishiura et al.	2005	4	2	1	7
8	Cheng et al.	2010	3	2	3	8
9	Jaeger et al.	2011	3	2	2	7
10	Chokephaibulkit et al.	2012	3	2	2	7
11	Zhang et al.	2012	3	2	3	8
12	Zhang et al.	2013	4	2	1	7
13	Sung et al.	2016	3	2	2	7
14	Zhang et al.	2017	3	2	1	6
15	Wang et al.	2020	3	1	1	5

[a] Scoring by Newcastle-Ottawa Scale.

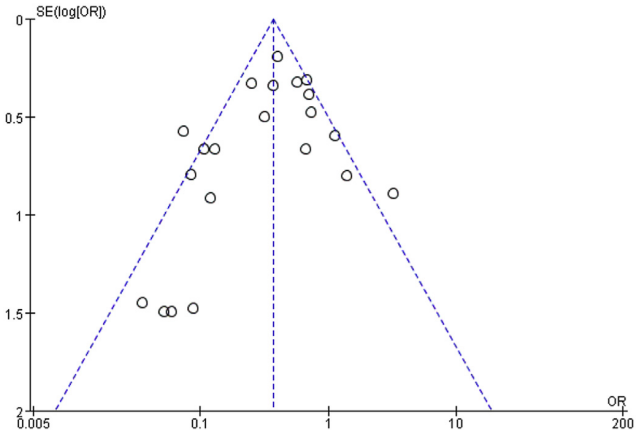


Fig. 2. Funnel plot of mask-wearing and risk of laboratory-confirmed respiratory viral infection.

respiratory droplets and coronavirus RNA in aerosols [38]. The SARS-CoV-2 aerosol, mainly appearing in submicron region (d_p between 0.25 and 1.0 μm) and supermicron region (d_p > 2.5 μm) [39], can be effectively filtered out from the inhaled air by either surgical masks or N95 masks [3,40]. Comparison of the incidence of COVID-19 in Hongkong, China with Spain, Italy, Germany, France, U.S., U.K., Singapore, and South Korea showed that community-wide mask wearing may assist in controlling COVID-19 with reduced emission of infected saliva and respiratory droplets from mildly symptomatic patients [41].

4.2. Protective effects for both HCWs and non-HCWs

During the current COVID-19 pandemic, HCWs are facing the dangers inherent in close contact with index-patients [42]. In Italy, more than 2,600 HCWs have been infected by March 19, 2020, accounting for 8.3% of the country's total cases [43]. According to our analysis, wearing masks significantly reduced the risk of infection among HCWs by 80%. It is noteworthy that, none of the 278 HCWs wearing N95 masks in quarantined areas were infected by SARS-CoV-2 yet, 10 of the 215 HCWs who did not wear masks in the open areas were infected [35]. Therefore, universal masking of HCWs at clinical settings is likely to provide great benefits for HCWs. especially during current COVID-19 pandemic. Moreover, protective benefits were also reported in hematopoietic stem cell transplant (HSCT) patients [33]. Besides, Sokol's study also found a reduced risk of hospital-acquired RVIs by putting surgical masks on all workers and visitors in every patient room on the bone marrow transplant unit [44]. Accumulative data showed that people with older age, immunosuppressed state and systematic commodities are at higher risk for severe COVID-19 infection [45–47], and therefore, should be protected with proper measures (e.g. prophylactic masking) during the current pandemic. In addition, those who have close contact with those populations at high risks of contracting RVIs should consider wearing masks as well.

More importantly, our data showed that masks worn by non-HCWs can also effectively prevent the spread of respiratory viruses and reduce the risk of virus infection by 56% in non-household settings, indicating the potential benefits of wearing masks for the general public. Moreover, significant protective effects were found in the study conducted in the general population [17], indicating the potential benefits of wearing masks for the general public. Interestingly, a recent COVID-19 dynamics modeling study suggested that broad adoption of even relatively ineffective non-medical grade “social” masks may meaningfully reduce the community transmission and decrease peak hospitalizations and deaths during the current COVID-19 pandemic [48]. Although laboratory-confirmed virus results show no difference between the mask group and the control group in a study investigating the wearing of masks by pilgrims, wearing masks reduced the risk of influenza-like illness when people gather [4]. This difference between laboratory-confirmed cases and clinically diagnosed influenza-like illness cases were likely due to an under-diagnosis of real cases caused by too few nasal swabs collected for laboratory confirmation. Zhang et al. conducted a case-control study and found that none of the passengers always wearing masks on an international flight were infected with H1N1 [32], and a recent case report [49] described a man who was wearing a mask at international flight and then tested positive for COVID-19, while 25 other people closest to him on the plane and flight attendants were all tested negative, further demonstrating the benefits of wearing masks during public transportations [50].

Protective effects were also found among household settings showing a 40% reduced risk of RVIs. However, masking with prudent implementation and high compliance is a prerequisite to ensure the successful protection, which is practically challenging especially for non-HCWs. Two household studies included in our analysis reported low facemask adherence among household contacts [23,24], which might explain the poor protective effects from these studies. In contrast, Suess et al. reported a good compliance, which showed a significant protective effect [29]. These findings implicated that proper use of masks has an impact on the effectiveness of preventing RVIs. Given that most people in household settings were unlikely to strictly follow hand

Table 3
The quality of randomized controlled studies.

	Study	Year	Randomization	Double-blind	Description of inclusion/exclusion criteria	Scores[a]
1	Cowling et al.	2008	2	0	1	3
2	Cowling et al.	2009	2	0	1	3
3	MacIntyre	2011	2	0	1	3
4	Suess et al.	2012	2	1	1	4
5	Ailello	2012	2	1	1	4
6	Barasheed et al.	2014	2	0	1	3

[a] Scoring by Jadad scale.

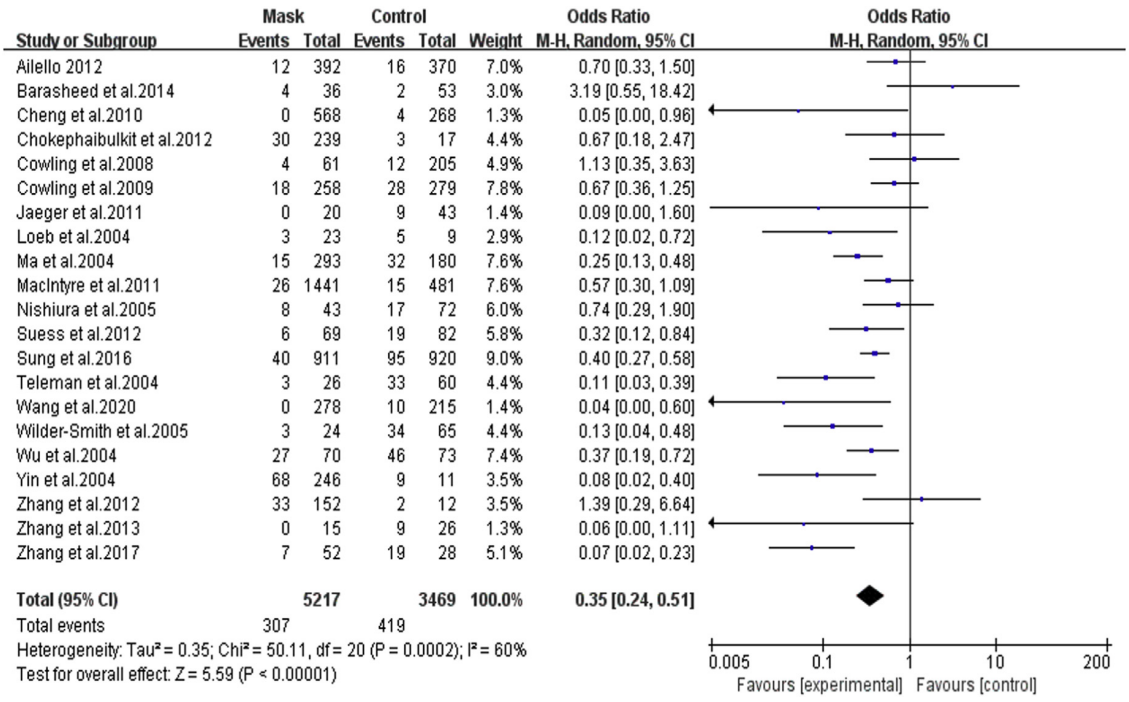


Fig. 3. Forest plot of the overall effect of mask-wearing on laboratory-confirmed respiratory viral infection.

hygiene and mask use recommendations [23], re-evaluating the home quarantine strategy might be essential during the current COVID-19 pandemic [51,52].

4.3. Protective effects against influenza, SARS, and COVID-19

The risk of influenza, SARS, and COVID-19 infection were reduced by 45%, 74%, and 96% by wearing masks, respectively, which were consistent with previous meta-analyses during the SARS outbreaks [9,53]. The previous systematic review from Xiao et al., though reporting non-significant protection of masks against the influenza virus [6], did not strictly follow the PRISMA statement and represented merely non-aggregated data. For example, there was one study [54] included by Xiao et al. did not report a significantly protection by wearing masks. However, it should be noted that the result of this study was not convincing because the H1N1 pandemic broke out during the study period, and the national hygiene campaign implemented at this time influenced all participants to wear masks [54].

The insignificantly reduced risk of H1N1 infection following masking could be partially explained by the relatively small sample size and multiple confounding factors (e.g. prior vaccination, hand hygiene, age, gender, and culture). Jeager et al., 2009 indicated that overall PPE use among HCWs was low; as more than 25% of HCWs in this study reported they never used PPE in any patient encounter, and only 17% reported wearing masks with every H1N1 patient encounter, which could significantly lower the sample size of data collected [27]. Also, the same study [27] indicated that the majority of HCWs had received regular seasonal influenza vaccination, which could play a role of confounding factor contributing to protective effects toward control group. Additionally, during acute outbreak of H1N1, specific preventive measures were lagged behind H1N1 exposures. This could suggest that HCWs might already have been infected before wearing masks, further decreasing the powers of data collected.

4.4. Consistent protective effects between Asian and western countries

Due to current controversial guidelines between different countries and areas, regarding the general public wearing masks. We also analyzed its effects based on different geographic locations, showing that wearing masks does provide protective effects in both Asian countries and western countries by 69% and 55%, respectively. Among HCWs, it reduced the risk in both Asian and western countries. Especially, for non-healthcare populations, reduced risk of 54% was found in western countries, and a reduced risk of 49% was found in Asia. This would suggest that the proper use of masks might play a significant role in public health efforts to suppress the spread of RVIs, regardless of the geographic locations, especially during an outbreak.

4.5. Limitations and future perspective

The present meta-analysis still has several limitations. First, well-designed high-quality prospective studies and studies of masking in the general public are still insufficient. Second, Droplet-borne and airborne viruses are likely to cause large-scale transmissions among the passengers within closed transportation vehicles [55]. However, relevant studies are relatively rare [32]. Third, this article included some studies of SARS patients diagnosed according to clinical diagnostic criteria for SARS due to a low detection rate of RT-PCR [56]. The lack of sufficient virologic evidence may affect our conclusions. However, this effect might not be significant, as 92% of patients with clinical SARS for whom paired sera were available had a > 4-fold rise in antibody titer to SARS-CoV [57]. Fourth, control subjects without masking are generally lacking in studies conducted in healthcare settings mainly due to the ethical issue. Future studies might choose HCWs from departments without needs of masking as controls [26]. Fifth, our study didn't have sufficient data for subgroup analysis of different mask types since our inclusion criteria mainly focused on masks versus no masks, which might inherently omit studies that focused on effectiveness of different mask types. Though there were published studies that had shown different specifications of masks and different wearing methods may affect the protective effect of masks [17,32]. And when the included studies divided the time/frequency of wearing masks, we only included the group of masks with the longest wearing/highest wearing frequency. This might also ignore effects of the short/infrequent mask-wearing. In

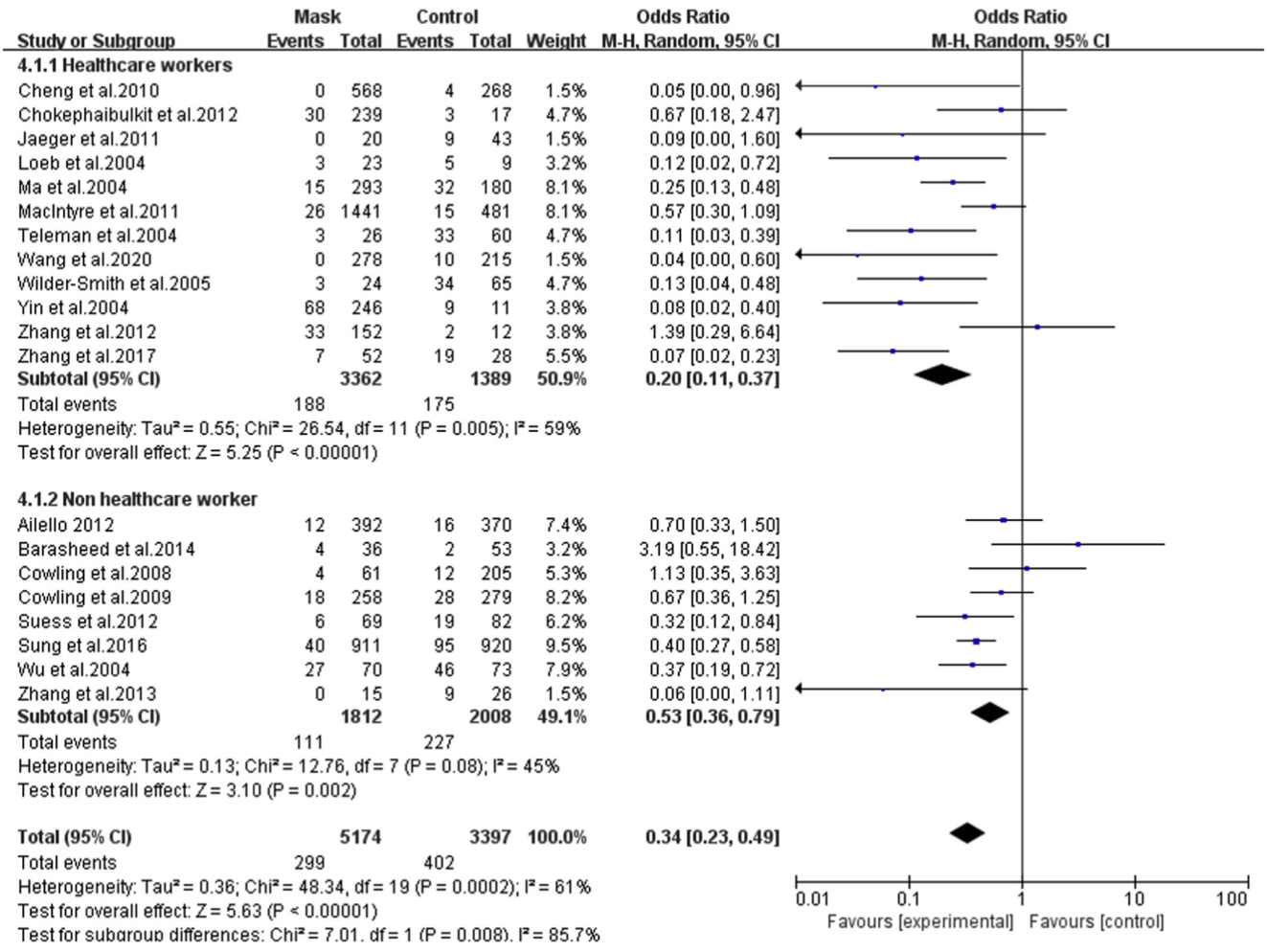


Fig. 4. Forest plot of the effect of mask-wearing on laboratory-confirmed respiratory viral infection among HCW and non-HCW.

Table 4
Meta-analysis results of effect of masks on laboratory-confirmed respiratory viral infection among different subgroups.

	Subgroup	Study numbers	OR	95%CI	Heterogeneity
Overall	–	21	0.35	0.24–0.51	60%
HCW vs Non-HCWs	HCWs	12	0.20	0.11–0.37	59%
	Non-HCWs	8	0.53	0.36–0.79	45%
Non-HCWs	Household	3	0.60	0.37–0.97	31%
	Non-household	5	0.44	0.33–0.59	54%
Countries	Asian	15	0.31	0.19–0.50	65%
	Western	6	0.45	0.24–0.83	51%
HCWs based on countries	Asian	10	0.21	0.11–0.41	64%
	Western	2	0.11	0.02–0.51	0%
Non- HCWs based on countries	Asian	4	0.51	0.34–0.78	64%
	Western	4	0.46	0.34–0.63	57%
Virus types	Influenza virus	12	0.55	0.39–0.76	27%
	SARS-CoV	7	0.26	0.18–0.37	47%
	SARS-CoV-2	1	0.04	0.00–0.60	0%
	H1N1	5	0.30	0.08–1.16	51%
Study designs	Cluster RCTs	6	0.65	0.47–0.91	20%
	Observational studies(cohort and case control studies)	15	0.24	0.15–0.38	52%

HCW: Healthcare workers; Non-HCWs: Non-healthcare workers; RCT: Randomized control trial.

addition, the studies we included were mainly conducted in Asia, especially China, and more evidence from other countries is needed to support our views. Last but not least, information about other confounding biases, such as vaccination, hand hygiene, age, gender, and culture, may affect the protective effect of masks.

5. Conclusion

The present systematic review and meta-analysis showed the general efficacy of masks in preventing the transmission of RVIs. Such protective effects of masking are evidentiary for both healthcare and non-healthcare workers and consistent between Asian and Western populations. More evidences are still needed to better clarify the effectiveness of masking in various circumstances.

Funding

This work was not supported by any funding.

CRediT authorship contribution statement

Mingming Liang: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing - original draft, Writing - review & editing. **Liang Gao:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing - original draft, Writing - review & editing. **Ce Cheng:** Investigation,

Writing - original draft, Writing - review & editing. **Qin Zhou:** Writing - review & editing. **John Patrick Uy:** Writing - review & editing. **Kurt Heiner:** Writing - review & editing. **Chenyu Sun:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing - original draft, Writing - review & editing.

Declaration of competing interest

We declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tmaid.2020.101751.

References

[1] World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020. 2020. [cited 2020 March 10]. https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020.

[2] Van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med 2020. https://doi.org/10.1056/NEJMc2004973.

[3] Davies A, Thompson K, Giri K, Kafatos G, Walker J, Bennett A. Testing the efficacy of homemade masks: would they protect in an influenza pandemic? Disaster Med Public Health Prep 2013;7:413–8. https://doi.org/10.1017/dmp.2013.43.

[4] Barasheed O, Almasri N, Badahdah A, Heron L, Taylor J, McPhee K, et al. Pilot randomised controlled trial to test effectiveness of facemasks in preventing influenza-like illness transmission amo ng Australian Hajj pilgrims in 2011. Infect Disord - Drug Targets 2014;14:110–6. https://doi.org/10.13140/RG.2.1.1889.9048.

[5] Lee SA, Grinshpun SA, Reponen T. Respiratory performance offered by N95 respirators and surgical masks: human subject evaluation with NaCl aerosol representing bacterial and viral particle size range. Ann Occup Hyg 2008;52:177–85. https://doi.org/10.1093/annhyg/men005.

[6] Xiao J, Shiu EY, Gao H, Wong JY, Fong MW, Ryu S, et al. Nonpharmaceutical measures for pandemic influenza in nonhealthcare settings-personal protective and environmental measures. Emerg Infect Dis 2020;26. https://doi.org/10.3201/eid2605.190994. [Epub ahead of print].

[7] Smith JD, MacDougall CC, Johnstone J, Copes RA, Schwartz B, Garber GE. Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis. CMAJ (Can Med Assoc J) 2016;188:567–74. https://doi.org/10.1503/cmaj.150835.

[8] Saunders-Hastings P, Crispo J, Sikora L, Krewski D. Effectiveness of personal protective measures in reducing pandemic influenza transmission: a systematic review and meta-analysis. Epidemics 2017;20:1–20. https://doi.org/10.1016/j.epidem.2017.04.003.

[9] Jefferson T, Foxlee R, Del Mar C, Dooley L, Ferroni E, Hewak B, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. BMJ 2008;336:77–80. https://doi.org/10.1136/bmj.39393.510347.BE.

[10] Wells G, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. 2009. [cited 2020 February5]. http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp.

[11] Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? Contr Clin Trials 1996;17:1–12. https://doi.org/10.1016/0197-2456(95)00134-4.

[12] DerSimonian R, Laird N. Meta-analysis in clinical trials. Contr Clin Trials 1986;7:177–88. https://doi.org/10.1016/0197-2456(86)90046-2.

[13] Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. Biometrics 1994;50:1088–101. https://doi.org/10.2307/2533446.

[14] Egger M, Davey SG, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ 1997;315:629–34. https://doi.org/10.1136/bmj.315.7109.629.

[15] The Cochrane Collaboration. Review manager (RevMan). 2014. Version 5.3.

[16] Teleman MD, Boudville IC, Heng BH, Zhu D, Leo YS. Factors associated with transmission of severe acute respiratory syndrome among health-care workers in Singapore. Epidemiol Infect 2004;132:797–803. https://doi.org/10.1017/S0950268804002766.

[17] Wu J, Xu F, Zhou W, Feikin DR, Lin C, He X, et al. Risk factors for SARS among persons without known contact with SARS patients, Beijing, China. Emerg Infect Dis 2004;10:210–6. https://doi.org/10.3201/eid1002.030730.

[18] Loeb M, McGeer A, Henry B, Ofner M, Rose D, Hlywka T, et al. SARS among critical care nurses, Toronto. Emerg Infect Dis 2004;10:251–5. https://doi.org/10.3201/eid1002.030838.

[19] Ma H, Wang H, Fang L, Jiang J, Wei M, Liu W, et al. A case-control study on the risk factors of severe acute respiratory syndromes among health care workers. Zhonghua Liuxingbingxue Zazhi 2004:13–6.

[20] Yin W, Gao L, Lin W, Du L, Zhang X, Zou Q, et al. Effectiveness of personal protective measures in prevention of nosocomial transmission of severe acute respiratory syndrome. Zhonghua Liuxingbingxue Zazhi 2004:26–30.

[21] Wilder-Smith A, Teleman MD, Heng BH, Earnest A, Ling AE, Leo YS. Asymptomatic SARS coronavirus infection among healthcare workers, Singapore. Emerg Infect Dis 2005;11:1142–5. https://doi.org/10.3201/eid1107.041165.

[22] Nishiura H, Kuratsuji T, Quy T, Phi NC, Van Ban V, LE Dang HA, et al. Rapid awareness and transmission of severe acute respiratory syndrome in Hanoi French Hospital, Vietnam. Am J Trop Med Hyg 2005;73:17–25. https://doi.org/10.4269/ajtmh.2005.73.17.

[23] Cowling BJ, Fung RO, Cheng CK, Fang VJ, Chan KH, Seto WH, et al. Preliminary findings of a randomized trial of non-pharmaceutical interventions to prevent influenza transmission in households. PloS One 2008;3:e2101https://doi.org/10.1371/journal.pone.0002101.

[24] Cowling BJ, Chan K, Fang VJ, Cheng CK, Fung RO, Wai W, et al. Facemasks and hand hygiene to prevent influenza transmission in households: a cluster randomized trial. Ann Intern Med 2009;151:437–46.

[25] Cheng VC, Tai JW, Wong L, Chan JF, Li IW, To K, et al. Prevention of nosocomial transmission of swine-origin pandemic influenza virus A/H1N1 by infection control bundle. J Hosp Infect 2010;74:271–7. https://doi.org/10.1016/j.jhin.2009.09.009.

[26] MacIntyre CR, Wang Q, Cauchemez S, Seale H, Dwyer DE, Yang P, et al. A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. Influenza Other Respir Viruses 2011;5:170–9. https://doi.org/10.1111/j.1750-2659.2011.00198.x.

[27] Jaeger JL, Patel M, Dharan N, Hancock K, Meites E, Mattson C, et al. Transmission of 2009 pandemic influenza A (H1N1) virus among healthcare personnel—southern California, 2009. Infect Contr Hosp Epidemiol 2011;32:1149–57. https://doi.org/10.1086/662709.

[28] Aiello AE, Perez V, Coulborn RM, Davis BM, Uddin M, Monto AS. Facemasks, hand hygiene, and influenza among young adults: a randomized intervention trial. PloS One 2012;7:e29744https://doi.org/10.1371/journal.pone.0029744.

[29] Suess T, Remschmidt C, Schink SB, Schweiger B, Nitsche A, Schroeder K, et al. The role of facemasks and hand hygiene in the prevention of influenza transmission in households: results from a cluster randomised trial; Berlin, Germany, 2009-2011. BMC Infect Dis 2012;12:12–26. https://doi.org/10.1186/1471-2334-12-26.

[30] Zhang Y, Seale H, Yang P, MacIntyre CR, Blackwell B, Tang S, et al. Factors associated with the transmission of pandemic (H1N1) 2009 among hospital healthcare workers in Beijing, China. Influenza Other Respir Viruses 2013;7:466–71.

[31] Chokephaibulkit K, Assanasen S, Apisarnthanarak A, Rongrungruang Y, Kachintorn K, Tuntiwattanapibul Y, et al. Seroprevalence of 2009 H1N1 virus infection and self-reported infection control practices among healthcare professionals following the first outbreak in bangkok, Thailand. Influenza Other Respir Viruses 2013;7:359–63. https://doi.org/10.1111/irv.12016.

[32] Zhang L, Peng Z, Ou J, Zeng G, Fontaine RE, Liu M, et al. Protection by face masks against influenza A (H1N1) pdm09 virus on trans-Pacific passenger aircraft, 2009. Emerg Infect Dis 2013;19:1403–10. https://doi.org/10.3201/eid1909.121765.

[33] Sung AD, Sung JA, Thomas S, Hyslop T, Gasparetto C, Long G, et al. Universal mask usage for reduction of respiratory viral infections after stem cell transplant: a prospective trial. Clin Infect Dis 2016;63:999–1006. https://doi.org/10.1093/cid/ciw451.

[34] Zhang L. Study on correlation between nosocomial respiratory virus infection and use of disposable respirator in medical staff. Nurs Pract Res 2017;14:118–9. https://doi.org/10.3969/j.issn.1672-9676.2017.22.046.

[35] Wang X, Pan Z, Cheng Z. Association between 2019-nCoV transmission and N95 respirator use. J Hosp Infect 2020:30097–9. https://doi.org/10.1016/j.jhin.2020.02.021. S0195-6701(20.

[36] Johnson DF, Druce JD, Birch C, Grayson ML. A quantitative assessment of the efficacy of surgical and N95 masks to filter influenza virus in patients with acute influenza infection. Clin Infect Dis 2009;49:275–7. https://doi.org/10.1086/600041.

[37] Guo ZD, Wang ZY, Zhang SF, Li X, Li L, Li C, et al. Aerosol and surface distribution of severe acute respiratory syndrome coronavirus 2 in hospital wards, Wuhan, China, 2020. Emerg Infect Dis 2020. https://doi.org/10.3201/eid2607.200885.

[38] Leung NHL, Chu DKW, Shiu EYC, Chan K-H, McDevitt JJ, Hau BJ-P, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nat Med 2020. https://doi.org/10.1038/s41591-020-0843-2.

[39] Liu Y, Ning Z, Chen Y, Guo M, Liu YL, Gail NK, et al. Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals. Nature 2020. https://doi.org/10.1038/s41586-020-2271-3.

[40] Garcia Godoy LR, Jones AE, Anderson TN, Fisher CL, Seeley KML, Beeson EA, et al. Facial protection for healthcare workers during pandemics: a scoping review. BMJ Glob Health 2020;5:e002553https://doi.org/10.1136/bmjgh-2020-002553.

[41] Cheng VC, Wong SC, Chuang VW, Chuang VW, So SY, Chen JH, et al. The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2. J Infect 2020. https://doi.org/10.1016/j.jinf.2020.04.024.

[42] Schwartz J, King C, Yen M. Protecting health care workers during the COVID-19 coronavirus outbreak–lessons from taiwan's SARS response. Clin Infect Dis 2020. https://doi.org/10.1093/cid/ciaa255.

[43] Stickings T, Dyer C. Five more Italian doctors die battling coronavirus: thirteen medics have now lost their lives, with 2,629 health workers infected-8.3% of country's total. 2020. [cited 2020 March 21]. https://www.dailymail.co.uk/news/article-8129499/More-2-600-medical-workers-infected-coronavirus-Italy.html.

[44] Sokol KA, De la Vega-Diaz I, Edmondson-Martin K, Kim S, Tindle S, Wallach F, et al. Masks for prevention of respiratory viruses on the BMT unit: results of a quality

initiative. Transpl Infect Dis 2016;18:965–7. https://doi.org/10.1111/tid.12608.
[45] Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. J Am Med Assoc 2020. https://doi.org/10.1001/jama.2020.1585.
[46] Murthy S, Gomersall CD, Fowler RA. Care for critically ill patients with COVID-19. J Am Med Assoc 2020. https://doi.org/10.1001/jama.2020.3633.
[47] Center for Disease Control and Prevention. Coronavirus disease 2019 (COVID-19). 2020. [cited 2020 March 17]. https://www.cdc.gov/coronavirus/2019-ncov/specific-groups/high-risk-complications.htm.
[48] Eikenberry SE, Mancuso M, Iboi E, Phan T, Eikenberry K, Kuang y, et al. To mask or not to mask: modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic. Infect Disease Model 2020;5:293–308. https://doi.org/10.1016/j.idm.2020.04.001.
[49] Schwartz KL, Murti M, Finkelstein M, Leis JA, Fitzgerald-Husek A, Bourns L, et al. Lack of COVID-19 transmission on an international flight vol. 192. 2020. p. E410. https://doi.org/10.1503/cmaj.75015.
[50] National Health Commission of the Prc. General prevention guidelines of 2019-nCoV infected pneumonia. 2020. [cited 2020 March 8]. http://www.nhc.gov.cn/xcs/kpzs/202001/3a13637e1a9249a2b6047f34b772b5e6.shtml.
[51] Chan JF, Yuan S, Kok K, To KK, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet 2020;395:514–23. https://doi.org/10.1016/S0140-6736(20)30154-9.
[52] Huang R, Xia J, Chen Y, Shan C, Wu C. A family cluster of SARS-CoV-2 infection involving 11 patients in Nanjing, China. Lancet Infect Dis 2020. https://doi.org/10.1016/S1473-3099(20)30147-X.
[53] Offeddu V, Yung CF, Low MSF, Tam CC. Effectiveness of masks and respirators against respiratory infections in healthcare workers: a systematic review and meta-analysis. Clin Infect Dis 2017;65:1934–42. https://doi.org/10.1093/cid/cix681.
[54] Simmerman JM, Suntarattiwong P, Levy J, Jarman RG, Kaewchana S, Gibbons RV, et al. Findings from a household randomized controlled trial of hand washing and face masks to reduce influenza transmission in Bangkok, Thailand. Influenza Other Respir. Viruses 2011;5:256–67. Findings from a household randomized controlled trial of hand washing and face masks to reduce influenza transmission in Bangkok, Thailand.
[55] National Health Commission of the Prc. Notice on issuing a new coronary virus pneumonia diagnosis and treatment plan (Trial Version 7) [cited 2020 March 17]. http://www.nhc.gov.cn/yzygj/s7653p/202003/46c9294a7dfe4cef80dc7f5912eb1989.shtml; 2020.
[56] Hui D, Cheong S, Wong PC, Wang C. SARS: clinical features and diagnosis. Respirology 2003;8:S20–4. https://doi.org/10.1046/j.1440-1843.2003.00520.x.
[57] Chan KH, Poon LL, Cheng V, Guan Y, Hung I, Kong J, et al. Detection of SARS coronavirus in patients with suspected SARS. Emerg Infect Dis 2004;10:294–9. https://doi.org/10.3201/eid1002.030610.

The NEW ENGLAND JOURNAL of MEDICINE

Perspective

OCTOBER 29, 2020

Facial Masking for Covid-19 — Potential for "Variolation" as We Await a Vaccine

Monica Gandhi, M.D., M.P.H., and George W. Rutherford, M.D.

As SARS-CoV-2 continues its global spread, it's possible that one of the pillars of Covid-19 pandemic control — universal facial masking — might help reduce the severity of disease and ensure that a greater proportion of new infections are asymptomatic. If this hypothesis is borne out, universal masking could become a form of "variolation" that would generate immunity and thereby slow the spread of the virus in the United States and elsewhere, as we await a vaccine.

One important reason for population-wide facial masking became apparent in March, when reports started to circulate describing the high rates of SARS-CoV-2 viral shedding from the noses and mouths of patients who were presymptomatic or asymptomatic — shedding rates equivalent to those among symptomatic patients.[1] Universal facial masking seemed to be a possible way to prevent transmission from asymptomatic infected people. The Centers for Disease Control and Prevention (CDC) therefore recommended on April 3 that the public wear cloth face coverings in areas with high rates of community transmission — a recommendation that has been unevenly followed across the United States.

Past evidence related to other respiratory viruses indicates that facial masking can also protect the wearer from becoming infected, by blocking viral particles from entering the nose and mouth.[2] Epidemiologic investigations conducted around the world — especially in Asian countries that became accustomed to population-wide masking during the 2003 SARS pandemic — have suggested that there is a strong relationship between public masking and pandemic control. Recent data from Boston demonstrate that SARS-CoV-2 infections decreased among health care workers after universal masking was implemented in municipal hospitals in late March.

SARS-CoV-2 has the protean ability to cause myriad clinical manifestations, ranging from a complete lack of symptoms to pneumonia, acute respiratory distress syndrome, and death. Recent virologic, epidemiologic, and ecologic data have led to the hypothesis that facial masking may also reduce the severity of disease among people who do become infected.[3] This possibility is consistent with a long-standing theory of viral pathogenesis, which holds that the severity of disease is proportionate to the viral inoculum received. Since 1938, researchers have explored, primarily in animal models, the concept of the lethal dose of a virus — or the dose at which 50% of exposed hosts die

(LD50). With viral infections in which host immune responses play a predominant role in viral pathogenesis, such as SARS-CoV-2, high doses of viral inoculum can overwhelm and dysregulate innate immune defenses, increasing the severity of disease. Indeed, downregulating immunopathology is one mechanism by which dexamethasone improves outcomes in severe Covid-19 infection. As proof of concept of viral inocula influencing disease manifestations, higher doses of administered virus led to more severe manifestations of Covid-19 in a Syrian hamster model of SARS-CoV-2 infection.[4]

If the viral inoculum matters in determining the severity of SARS-CoV-2 infection, an additional hypothesized reason for wearing facial masks would be to reduce the viral inoculum to which the wearer is exposed and the subsequent clinical impact of the disease. Since masks can filter out some virus-containing droplets (with filtering capacity determined by mask type),[2] masking might reduce the inoculum that an exposed person inhales. If this theory bears out, population-wide masking, with any type of mask that increases acceptability and adherence,[2] might contribute to increasing the proportion of SARS-CoV-2 infections that are asymptomatic. The typical rate of asymptomatic infection with SARS-CoV-2 was estimated to be 40% by the CDC in mid-July, but asymptomatic infection rates are reported to be higher than 80% in settings with universal facial masking, which provides observational evidence for this hypothesis. Countries that have adopted population-wide masking have fared better in terms of rates of severe Covid-related illnesses and death, which, in environments with limited testing, suggests a shift from symptomatic to asymptomatic infections. Another experiment in the Syrian hamster model simulated surgical masking of the animals and showed that with simulated masking, hamsters were less likely to get infected, and if they did get infected, they either were asymptomatic or had milder symptoms than unmasked hamsters.

The most obvious way to spare society the devastating effects of Covid-19 is to promote measures to reduce both transmission and severity of illness. But SARS-CoV-2 is highly transmissible, cannot be contained by syndromic-based surveillance alone,[1] and is proving difficult to eradicate, even in regions that implemented strict initial control measures. Efforts to increase testing and containment in the United States have been ongoing and variably successful, owing in part to the recent increase in demand for testing.

The hopes for vaccines are pinned not just on infection prevention: most vaccine trials include a secondary outcome of decreasing the severity of illness, since increasing the proportion of cases in which disease is mild or asymptomatic would be a public health victory. Universal masking seems to reduce the rate of new infections; we hypothesize that by reducing the viral inoculum, it would also increase the proportion of infected people who remain asymptomatic.[3]

In an outbreak on a closed Argentinian cruise ship, for example, where passengers were provided with surgical masks and staff with N95 masks, the rate of asymptomatic infection was 81% (as compared with 20% in earlier cruise ship outbreaks without universal masking). In two recent outbreaks in U.S. food-processing plants, where all workers were issued masks each day and were required to wear them, the proportion of asymptomatic infections among the more than 500 people who became infected was 95%, with only 5% in each outbreak experiencing mild-to-moderate symptoms.[3] Case-fatality rates in countries with mandatory or enforced population-wide masking have remained low, even with resurgences of cases after lockdowns were lifted.

Variolation was a process whereby people who were susceptible to smallpox were inoculated with material taken from a vesicle of a person with smallpox, with the intent of causing a mild infection and subsequent immunity. Variolation was practiced only until the introduction of the variola vaccine, which ultimately eradicated smallpox. Despite concerns regarding safety, worldwide distribution, and eventual uptake, the world has high hopes for a highly effective SARS-CoV-2 vaccine, and as of early September, 34 vaccine candidates were in clinical evaluation, with hundreds more in development.

While we await the results of vaccine trials, however, any public health measure that could increase the proportion of asymptomatic SARS-CoV-2 infections may both make the infection less deadly and increase population-wide immunity without severe illnesses and deaths. Reinfection with SARS-CoV-2 seems to be rare, despite more than 8 months of circulation worldwide and as suggested by a macaque model. The scientific community has been clarifying for some time the humoral and cell-mediated components of the adaptive immune response to SARS-CoV-2 and the

inadequacy of antibody-based seroprevalence studies to estimate the level of more durable T-cell and memory B-cell immunity to SARS-CoV-2. Promising data have been emerging in recent weeks suggesting that strong cell-mediated immunity results from even mild or asymptomatic SARS-CoV-2 infection,[5] so any public health strategy that could reduce the severity of disease should increase population-wide immunity as well.

To test our hypothesis that population-wide masking is one of those strategies, we need further studies comparing the rate of asymptomatic infection in areas with and areas without universal masking. To test the variolation hypothesis, we will need more studies comparing the strength and durability of SARS-CoV-2–specific T-cell immunity between people with asymptomatic infection and those with symptomatic infection, as well as a demonstration of the natural slowing of SARS-CoV-2 spread in areas with a high proportion of asymptomatic infections.

Ultimately, combating the pandemic will involve driving down both transmission rates and severity of disease. Increasing evidence suggests that population-wide facial masking might benefit both components of the response.

Disclosure forms provided by the authors are available at NEJM.org.

From the Center for AIDS Research, Division of HIV, Infectious Diseases, and Global Medicine, Department of Medicine (M.G.), and the Division of Infectious Disease and Global Epidemiology, Department of Epidemiology and Biostatistics (G.W.R.), University of California, San Francisco, San Francisco.

This article was published on September 8, 2020, at NEJM.org.

1. Gandhi M, Yokoe DS, Havlir DV. Asymptomatic transmission, the Achilles' heel of current strategies to control Covid-19. N Engl J Med 2020;382:2158-60.
2. van der Sande M, Teunis P, Sabel R. Professional and home-made face masks reduce exposure to respiratory infections among the general population. PLoS One 2008;3(7):e2618.
3. Gandhi M, Beyrer C, Goosby E. Masks do more than protect others during COVID-19: reducing the inoculum of SARS-CoV-2 to protect the wearer. J Gen Intern Med 2020 July 31 (Epub ahead of print).
4. Imai M, Iwatsuki-Horimoto K, Hatta M, et al. Syrian hamsters as a small animal model for SARS-CoV-2 infection and countermeasure development. Proc Natl Acad Sci U S A 2020;117:16587-95.
5. Sekine T, Perez-Potti A, Rivera-Ballesteros O, et al. Robust T cell immunity in convalescent individuals with asymptomatic or mild COVID-19. Cell 2020 August 11 (Epub ahead of print).

DOI: 10.1056/NEJMp2026913

BMJ Global Health

Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China

Yu Wang,[1] Huaiyu Tian,[2] Li Zhang,[1] Man Zhang,[3] Dandan Guo,[4] Wenting Wu,[1] Xingxing Zhang,[3] Ge Lin Kan,[5] Lei Jia,[1] Da Huo,[1] Baiwei Liu,[1] Xiaoli Wang,[1] Ying Sun,[1] Quanyi Wang,[1] Peng Yang,[3] C. Raina MacIntyre[6,7]

To cite: Wang Y, Tian H, Zhang L, *et al*. Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. *BMJ Global Health* 2020;**5**:e002794. doi:10.1136/bmjgh-2020-002794

Handling editor Seye Abimbola

Received 1 May 2020
Revised 9 May 2020
Accepted 11 May 2020

For numbered affiliations see end of article.

Correspondence to
Dr Quanyi Wang;
wangquanyi@protonmail.com
and
Dr Peng Yang;
yangpengcdc@163.com

ABSTRACT

Introduction Transmission of COVID-19 within families and close contacts accounts for the majority of epidemic growth. Community mask wearing, hand washing and social distancing are thought to be effective but there is little evidence to inform or support community members on COVID-19 risk reduction within families.

Methods A retrospective cohort study of 335 people in 124 families and with at least one laboratory confirmed COVID-19 case was conducted from 28 February to 27 March 2020, in Beijing, China. The outcome of interest was secondary transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) within the family. Characteristics and practices of primary cases, of well family contacts and household hygiene practices were analysed as predictors of secondary transmission.

Results The secondary attack rate in families was 23.0% (77/335). Face mask use by the primary case and family contacts before the primary case developed symptoms was 79% effective in reducing transmission (OR=0.21, 95% CI 0.06 to 0.79). Daily use of chlorine or ethanol based disinfectant in households was 77% effective (OR=0.23, 95% CI 0.07 to 0.84). Wearing a mask after illness onset of the primary case was not significantly protective. The risk of household transmission was 18 times higher with frequent daily close contact with the primary case (OR=18.26, 95% CI 3.93 to 84.79), and four times higher if the primary case had diarrhoea (OR=4.10, 95% CI 1.08 to 15.60). Household crowding was not significant.

Conclusion The study confirms the highest risk of transmission prior to symptom onset, and provides the first evidence of the effectiveness of mask use, disinfection and social distancing in preventing COVID-19. We also found evidence of faecal transmission. This can inform guidelines for community prevention in settings of intense COVID-19 epidemics.

Summary box

What is already known?

- Mitigation of the COVID-19 pandemic depends solely on non-pharmaceutical interventions until drugs or vaccines are available. Transmission of COVID-19 within families and close contacts accounts for the majority of epidemic growth. Community mask wearing, hand washing and social distancing are thought to be effective but the evidence is not clear.

What are the new findings?

- The overall secondary attack rate in households was 23.0%. Face masks were 79% effective and disinfection was 77% effective in preventing transmission, while close frequent contact in the household increased the risk of transmission 18 times, and diarrhoea in the index patient increased the risk by four times. The results demonstrate the importance of the pre-symptomatic infectiousness of COVID-19 patients and shows that wearing masks after illness onset does not protect.

What do the new findings imply?

- The findings inform universal face mask use and social distancing, not just in public spaces, but inside the household with members at risk of getting infected. This further supports universal face mask use, and also provides guidance on risk reduction for families living with someone in quarantine or isolation, and families of health workers, who may face ongoing risk.

INTRODUCTION

In the absence of a vaccine for COVID-19, non-pharmaceutical interventions (NPIs) are the only available disease control measures. We have shown that population level NPIs, including travel bans and the national emergency response, were effective in flattening

the COVID-19 epidemic curve in China.[1] However, the effect of other NPIs, such as mask use and hygiene practices, have not been well studied in the COVID-19 pandemic.

In the USA, the use of face masks in the community has been recommended.[2] It is thought that universal face mask use (UFMU) may reduce outward transmission from asymptomatically infected people and protect well people from becoming infected. However, the World Health Organization and Public Health England recommend against UFMU on the grounds that there is little evidence from randomised controlled trials to support this. Some experts suggest that in a pandemic, the precautionary principle should be used and UFMU encouraged as it is unlikely to cause harm and may result in public health gain.[3 4] In countries where personal protective equipment is scarce, people are making their own masks.

In China, over 70% of human-to-human transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) occurred in families.[5 6] However, data to inform COVID-19 risk reduction in households are unavailable. Given epidemic growth is dominated by household transmission,[5 6] studying the use of NPIs, such as face masks, social distancing and disinfection in the household setting, may inform community epidemic control and prevent transmission of COVID-19 in households.

METHODS

Study population and design

We conducted a retrospective cohort study involving families of laboratory confirmed COVID-19 cases in Beijing, China. We defined family members as those who had lived with primary cases in a house for 4 days before and for more than 24 hours after the primary cases developed illness related to COVID-19. As of 21 February 2020, all laboratory confirmed COVID-19 cases reported in Beijing were enrolled in our study and followed-up. The outcome of interest was secondary transmission in the household. Families with secondary transmission were defined as those where some or all of the family members become infected within one incubation period (2 weeks) of symptom onset of the primary case.

To analyse the predictors of household transmission, we compared families with and without secondary transmission for various measured risk factors, preventive interventions and exposures.

Definition of confirmed case

According to national prevention and control guideline (fifth edition),[7] confirmed cases were those who met the clinical, epidemiological and laboratory testing criteria for COVID-19 simultaneously.

1. Clinical criteria included: (a) fever and/or one or more respiratory symptoms; (b) radiological evidence of pneumonia; (c) white blood cell count normal or decreased, and lymphocyte count decreased at the early stage of illness.
2. Epidemiological criteria included: (a) visits to/living in Wuhan or cities around Wuhan or other communities which had already reported COVID-19 cases in the 14 days prior to the onset of symptoms; (b) having contact with a person known to have infection with SARS-CoV-2 in the 14 days prior to onset of symptoms; (c) having contact with a person who had fever or respiratory symptoms and came from Wuhan or adjacent cities or other communities which had already reported COVID-19 cases in the 14 days prior to onset of symptoms; (d) being one of the cluster cases.

Suspected cases met one of the epidemiological criteria and any two of the clinical criteria, or met all of the clinical criteria. Confirmed cases were those suspected cases who met one of the following criteria: (a) respiratory or blood specimen tested positive for SARS-CoV-2 by real time reverse transcriptase-polymerase chain reaction; (b) virus in respiratory or blood specimen was highly homologous with known SARS-CoV-2 through gene sequencing.

Data collection

A three part structured questionnaire was developed. The first part included demographic and clinical information of the primary case. The second part was mainly focused on the primary case's knowledge about and attitudes toward COVID-19, and their self-reported practices (mask wearing, social distancing, living arrangements) and activities in the home. The third part was about self-reported behaviours of all family members, as well as the family's accommodation and household hygiene practices from 4 days before the illness onset to the day the primary case was isolated, including room ventilation, room cleaning and disinfection. Close contact was defined as being within 1 m or 3 feet of the primary case, such as eating around a table or sitting together watching TV. The frequency of contact, disinfection and ventilation was measured.

After diagnosis, the primary case was hospitalised as per standard practice in Beijing. Eligible primary cases and their family members were interviewed between 28 February and 8 March. Data on the primary case were extracted from epidemiological investigating reports from Beijing Centre for Disease Prevention and Control and supplemented by interview.

The clinical severity of the COVID-19 case was categorised as mild, severe or critical. Mild disease included non-pneumonia and mild pneumonia cases. Severe disease was characterised by dyspnoea, respiratory frequency ≥30/min, blood oxygen saturation ≤93%, PaO2/FiO2 ratio <300 and/or lung infiltrates >50% within 24–48 hours. Critical cases were those who exhibited respiratory failure, septic shock and/or multiple organ dysfunction/failure.[8]

Statistical analysis

Risk factors for secondary transmission were analysed by characteristics of the primary case, characteristics of well family members and household hygiene practices. Categorical variables are presented as counts and percentages, and continuous variables as medians (IQR). The χ^2 test and Fisher exact test were applied to compare difference between groups when necessary. A composite COVID-19 knowledge score and hand hygiene score were created with multiple sub-questions. A multivariable logistic regression model was used to identify risk factors associated with SARS-CoV-2 household transmission. Univariable analysis was first performed with all measures and only those variables significant at $p<0.1$ could be selected in the following multivariable logistic regression analysis. Backward elimination was performed to establish a final model retaining those with $p<0.05$ in the model. Statistical analyses were performed using SAS software (V.9.4).

Ethics statement

As our study was embedded within the COVID-19 prevention and control practice within public health units, and the telephone interview was a supplementary survey of the epidemiological field investigation, ethics approval was not required. We obtained subjects' verbal informed consent before the start of the interviews.

Patient and public involvement

No patients or the public were involved in the study design, setting the research questions, interpretation or writing up of results, or reporting of the research.

RESULTS

As of 21 February 2020, 399 confirmed COVID-19 cases in 181 families were reported in Beijing. Four family clusters were excluded because we were unable to determine whether there was secondary transmission or co-exposure, leaving 177 families. After reviewing information in the epidemiological investigation reports and survey calls, 40 families were excluded as they did not meet the study inclusion criteria. A further 13 families declined to be interviewed and were also excluded, leaving 124 families for study (figure 1).

Over the 2 weeks of follow-up from onset of the primary case, secondary transmission occurred in 41/124 families (77 secondary cases), and 83/124 families had no secondary transmission. The overall secondary attack rate in families was 23.0% (77/335). In the secondary transmission group, 41 primary cases caused 77 secondary cases, with a median secondary case number in families of 2 (IQR 1–2). In the secondary transmission group, the secondary attack rate in children <18 years of age was 36.1% (13/36), compared with 69.6% (64/92) in adults, and the difference between these two age groups was significant (χ^2=12.08, $p<0.001$). The median age of the 13 secondary child cases was 3 years (IQR 2–6), 12/13 were

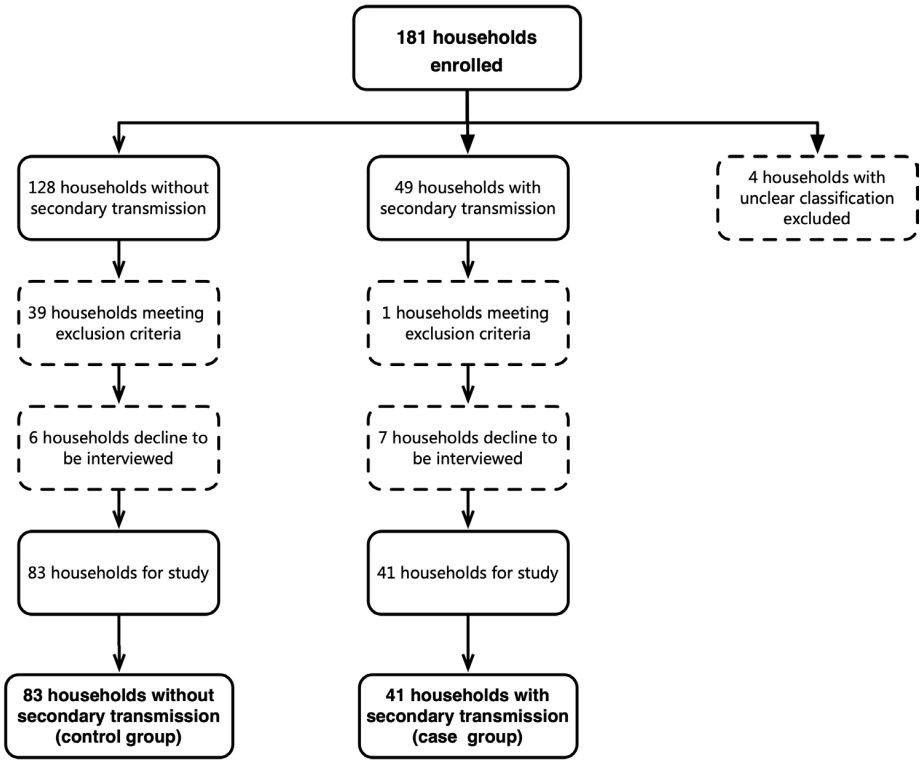


Figure 1 Selection and inclusion of interviewing subjects. Summary of household enrolment, and inclusion and interview response in the analysis of SARS-CoV-2 household transmission in Beijing, China.

Table 1 Characteristics of primary cases of COVID-19: univariable analysis

Primary cases	Total (n (%)) (n=124)	Families without transmission (n (%)) (n=83)	Families with transmission (n (%)) (n=41)	P value	Unadjusted OR (95% CI)
Age (years) (median (IQR))	45.0 (35.7–60.0)	42.0 (34.0–57.5)	52.0 (39.3–61.0)	–	–
<18	0	0	0	–	–
18–59	92 (74.2)	63 (75.9)	29 (70.7)	–	Ref
≥60	32 (25.8)	20 (24.1)	12 (29.3)	0.54	1.30 (0.56 to 3.02)
Sex	–	–	–	–	–
Men	61 (49.2)	40 (48.2)	21 (51.2)	–	Ref
Women	63 (50.8)	43 (51.8)	20 (48.8)	0.75	0.89 (0.42 to 1.87)
Education level	–	–	–	–	–
High school or lower	26 (21.0)	18 (21.7)	8 (19.5)	–	Ref
Bachelor degree	69 (55.6)	47 (56.6)	22 (53.7)	0.53	0.75 (0.30 to 1.86)
Graduate degree	29 (23.4)	18 (21.7)	11 (26.8)	0.65	0.77 (0.25 to 2.38)
Clinical severity	–	–	–	–	–
Mild	96 (77.4)	63 (75.9)	33 (80.4)	–	Ref
Severe	20 (16.1)	16 (19.3)	4 (9.8)	0.22	0.48 (0.15 to 1.54)
Critical	8 (6.5)	4 (4.8)	4 (9.8)	0.38	1.91 (0.45 to 8.13)
Fever (≥37.3℃)	–	–	–	–	–
No	18 (14.5)	9 (10.8)	9 (22.0)	–	Ref
Yes	106 (85.5)	74 (89.2)	32 (78.0)	0.11	0.43 (0.16 to 1.19)
Cough*	–	–	–	–	–
No	66 (53.2)	45 (54.2)	21 (51.2)	–	Ref
Yes	58 (46.8)	38 (45.8)	20 (48.8)	0.75	1.13 (0.53 to 2.39)
Diarrhoea†	–	–	–	–	–
No	109 (87.9)	76 (91.6)	33 (80.5)	–	Ref
Yes	15 (12.1)	7 (8.4)	8 (19.5)	0.08	2.63 (0.88 to 7.85)
Comorbidity	–	–	–	–	–
No	103 (83.1)	72 (86.7)	31 (75.6)	–	Ref
Yes	21 (16.9)	11 (13.3)	10 (24.4)	0.13	2.11 (0.81 to 5.48)
Time interval from illness onset to first hospital visit (days) (median (IQR))‡	3.0 (1.0–7.0)	3.0 (1.0–7.0)	4.0 (2.0–7.0)	–	–
≤2	47 (37.9)	35 (42.2)	12 (29.3)	–	Ref
>2	77 (62.1)	48 (57.8)	29 (70.7)	0.17	1.76 (0.79 to 3.93)
Time interval from illness onset to medical isolation (days) (median (IQR))	5.0 (2.0–7.0)	5.0 (2.0–7.0)	5.0 (3.0–9.0)	–	–
≤2	32 (25.8)	26 (31.3)	6 (14.6)	–	Ref
>2	92 (74.2)	57 (68.7)	35 (85.4)	**0.05**	2.66 (1.00 to 7.12)
Time interval from illness onset to laboratory confirmation (days) (median (IQR))	7.0 (4.7–10.2)	7.0 (4.4–9.9)	8.0 (5.6–12.9)	–	–
≤3	16 (12.9)	13 (15.7)	3 (7.3)	–	Ref
>3	108 (87.1)	70 (84.3)	38 (92.7)	0.20	2.35 (0.63 to 8.77)
Knowledge score on COVID-19 before illness onset (14 in total) (median (IQR))§	5 (0–9)	5 (0–9)	5 (0–10)	–	–
≥10	31 (25.0)	18 (21.7)	13 (31.7)	–	Ref
3–9	45 (36.3)	32 (38.6)	13 (31.7)	0.24	0.56 (0.22 to 1.47)
≤2	48 (38.7)	33 (39.7)	15 (36.6)	0.33	0.63 (0.25 to 1.61)
Self-awareness of being infected with SARS-CoV-2 when developed illness	–	–	–	–	–
Likely	45 (36.3)	35 (42.2)	10 (24.4)	–	Ref

Continued

Table 1 Continued

Primary cases	Total (n (%)) (n=124)	Families without transmission (n (%)) (n=83)	Families with transmission (n (%)) (n=41)	P value	Unadjusted OR (95% CI)
Unlikely	79 (63.7)	48 (57.8)	31 (75.6)	0.06	2.26 (0.98 to 5.21)
Knowledge of their own infectiousness after illness onset	–	–	–	–	–
Likely	84 (67.7)	62 (74.7)	22 (53.7)	–	Ref
Unlikely	40 (32.3)	21 (25.3)	19 (46.3)	0.02	2.55 (1.16 to 5.61)
Wear mask at home after illness onset¶	–	–	–	–	–
Never	41 (33.1)	24 (28.9)	17 (41.5)	–	Ref
Sometimes	37 (29.8)	21 (25.3)	16 (39.0)	0.76	1.15 (0.46 to 2.87)
All the time	46 (37.1)	38 (45.8)	8 (19.5)	0.02	0.30 (0.11 to 0.82)
Self-isolated after illness onset	–	–	–	–	–
Yes	79 (63.7)	58 (69.9)	21 (51.2)	–	Ref
No	45 (36.3)	25 (30.1)	20 (48.8)	0.05	2.17 (1.00 to 4.70)
Eat separately at home after illness onset	–	–	–	–	–
Yes	70 (56.5)	54 (65.1)	16 (39.0)	–	Ref
No	54 (43.5)	29 (34.9)	25 (61.0)	0.008	2.86 (1.32 to 6.19)
Eat with separate tableware	–	–	–	–	–
Yes	81 (65.3)	58 (69.9)	23 (56.1)	–	Ref
No	43 (34.7)	25 (30.1)	18 (43.9)	0.14	1.78 (0.82 to 3.88)
Score on hand hygiene (8 in total) (with 11 missing values) (median (IQR))	8 (7–8)	8 (7–8)	7 (6–8)	–	–
≥6	103 (91.2)	68 (93.2)	35 (87.5)	–	Ref
4–5	7 (6.2)	4 (5.5)	3 (7.5)	0.63	1.46 (0.31 to 6.88)
≤3	3 (2.6)	1 (1.3)	2 (5.0)	0.28	3.88 (0.34 to 44.29)

*Primary case ever had the symptom of cough when living with others at home.
†Primary case ever had the symptom of diarrhoea (change of character of stool) when living with others at home.
‡Date on which cases self-reported the appearance of either fever (≥37.3°C) or any respiratory symptom during epidemiological investigation. Date of hospital visit was the earliest date that cases sought medical service for COVID-19 related illness.
§A composite variable involving the primary case's knowledge on the infectivity of SARS-CoV-2, contagious population, transmission route, susceptible population, incubation period, common symptoms and preventive measures.
¶Refers to the primary case or family members wearing a face mask at home, regardless of whether it was a N95 mask, disposable surgical mask or a common mask, including cloth mask. Wearing masks all the time means the primary case wears a mask all the time except when having dinner or sleeping at home.
**A composite variable involving the primary case's hand washing practice, including using running water, washing frequency, using sanitiser and under what conditions.

mild and 1/13 was asymptomatic. Of 64 secondary adult cases, 82.8% (53/64) were mild, 10.9% (7/64) were severe, 1.6% (1/64) was critical and 4.7% (3/64) were asymptomatic. No statistically significant difference was observed in clinical severity between 41 index adult cases (table 1) and 64 secondary adult cases for the secondary transmission group (p=0.18).

The univariable analysis for association with secondary transmission of SARS-CoV-2 within families is shown in tables 1–3. Significant associations were:

1. Characteristics, behaviours and knowledge of the primary case: having diarrhoea, interval from illness onset to medical isolation >2 days, self-awareness of being infected with SARS-CoV-2 when the primary case developed the illness, lack of knowledge of their own infectiousness, mask wearing in the home after illness onset, failing to self-isolate and not eating separately were associated with transmission (table 1).
2. Behaviours of family members: having daily close contact with the primary case at home, and number of family members wearing a mask in the home before and after the primary case's illness onset date were associated with transmission (table 2).
3. Household practices: frequency of using chlorine or ethanol based disinfectant for household cleaning and household ventilation duration were protective (table 3).

In multivariable logistic regression model, four factors remained significantly associated with secondary transmission. The primary case having diarrhoea in the home and daily close contact with the primary case in the home increased the risk. Transmission was significantly reduced

Table 2 Characteristics of well family members: univariable analysis

Family members	Total (n (%)) (n=121)	Families without transmission (n (%)) (n=81)	Families with transmission (n (%)) (n=40)	P value	Unadjusted OR (95% CI)
Family size (median (IQR))	4 (3–5)	3 (3–5)	4 (3–6)	–	–
≤3	56 (46.3)	41 (50.6)	15 (37.5)	–	Ref
>3	65 (53.7)	40 (49.4)	25 (62.5)	0.18	1.71 (0.79 to 3.71)
Close contact with primary cases at home (within 1 m or 3 feet) (No of times)*	–	–	–	–	–
0	41 (33.9)	36 (44.4)	5 (12.5)	–	Ref
1–3	61 (50.4)	38 (46.9)	23 (57.5)	**0.005**	4.55 (1.57 to 13.20)
≥4	19 (15.7)	7 (8.7)	12 (30.0)	**<0.001**	12.34 (3.30 to 46.23)
No of family members wearing mask at home before primary case's illness onset date (median (IQR))†	0 (0–1)	0 (0–2)	0 (0–0)	–	–
None	90 (74.4)	54 (66.7)	36 (90.0)	–	Ref
One or more	31 (25.6)	27 (33.3)	4 (10.0)	**0.009**	0.22 (0.07 to 0.69)
No of family members wearing mask at home after primary case's illness onset date (median (IQR))‡	1 (0–3)	2 (0–3)	0 (0–3)	–	–
None	47 (38.8)	26 (32.1)	21 (52.5)	–	Ref
Some	38 (31.4)	24 (29.6)	14 (35.0)	0.47	0.72 (0.30 to 1.73)
All	36 (29.8)	31 (38.3)	5 (12.5)	**0.004**	0.20 (0.07 to 0.60)

*Family members stay with the primary case at a short distance (within 1 m or 3 feet) for more than 10 min at a time. For example, they have dinner with the primary case around a table or watch TV sitting near.
†Before the primary case developed the illness, the primary case or his/her family contacts wear masks all the time at home.
‡When the primary case developed the illness, the primary case's family contacts wear masks all the time living with the primary case at home.

by frequent use of chlorine or ethanol based disinfectant in households and family members (including the primary case) wearing a mask at home before the primary case developed the illness (table 4).

DISCUSSION

This study confirms that the highest risk of household transmission is prior to symptom onset, but that precautionary NPIs, such as mask use, disinfection and social distancing in households can prevent COVID-19 transmission during the pandemic. This study is the first to confirm the effectiveness of mask use prior to symptom onset by family members, daily household disinfection and social distancing in the home. This could inform precautionary guidelines for families to reduce intrafamilial transmission in areas where there is high community transmission or other risk factors for COVID-19. Household transmission is a major driver of epidemic growth.[5 6] Further, in countries where health system capacity is exhausted, many people with infection are required to self-isolate at home, where their household contacts will be at risk of infection. In our study, the median family size of the 124 families was 4 (range 2–9), usually with children, parents and grandparents, which is similar to the social structure of most Chinese families.[9] Therefore, the risk of SARS-CoV-2 household transmission is high if a primary case was introduced and no measure was adopted. We showed that NPIs are effective at preventing transmission, even in homes that are crowded and small. UFMU is a low risk intervention with potential public health benefits.[3 4] The results suggest that community face mask use is likely to be the most effective inside the household during severe epidemics.

Almost a quarter of family members became infected, and the findings suggest that the risk was highest either before symptom onset or early in the clinical illness, as most primary cases were hospitalised after diagnosis, and interventions were not effective if applied after symptom onset. In the univariate analysis, wearing a mask after illness onset was significant, but in multivariate analysis, only wearing it before symptom onset was effective. Viral load is highest in the 2 days before symptom onset and on the first day of symptoms, and up to 44% of transmission is during the pre-symptomatic period in settings with substantial household clustering.[10 11] This supports UFMU, probably by reducing onward transmission from people in the pre-symptomatic phase of the illness[12 13] as well as protecting well mask users. Randomised clinical trials of face masks in the household have confirmed protection against other respiratory viruses if compliant, if used within 36 hours of the primary case symptom onset, and alone or in combination with hand hygiene.[14 15] This study now provides specific evidence for UFMU in settings of high epidemic growth to protect against COVID-19. In our study, 91.2% (103/113) of primary cases had a high score on hand hygiene, but it was not effective, confirming the results of previous randomised clinical trials which showed hand

Table 3 Characteristics of the residence and household practices: univariable analysis between two family groups

Residence and household practices	Total (n (%)) (n=121)	Families without transmission (n (%)) (n=81)	Families with transmission (n (%)) (n=40)	P value	Unadjusted OR (95% CI)
Residential area per capita (m^2) (median (IQR))	25.0 (17.3–35.0)	28.0 (18.0–35.8)	20.0 (16.9–31.8)	–	–
≤20	50 (41.3)	30 (37.1)	20 (50.0)	–	Ref
20–40	49 (40.5)	36 (44.4)	13 (32.5)	0.16	0.54 (0.23 to 1.27)
≥40	22 (18.2)	15 (18.5)	7 (17.5)	0.51	0.70 (0.24 to 2.02)
No of bedrooms per person (median (IQR))	0.7 (0.5–1.0)	0.7 (0.5–1.0)	0.7 (0.5–1.0)	–	–
≥1	39 (32.2)	28 (34.6)	11 (27.5)	–	Ref
<1	82 (67.8)	53 (65.4)	29 (72.5)	0.49	1.34 (0.59 to 3.08)
No of washrooms (median (IQR))	1 (1–2)	1 (1–2)	1 (1–2)	–	–
2 or more	34 (28.1)	23 (28.4)	11 (27.5)	–	Ref
1	87 (71.9)	58 (71.6)	29 (72.5)	0.87	1.07 (0.46 to 2.49)
Frequency of room cleaning (wet type)	–	–	–		–
Once in 1–2 days	83 (68.6)	59 (72.8)	24 (60.0)	–	Ref
Once in >2 days	38 (31.4)	22 (27.2)	16 (40.0)	0.11	1.90 (0.86 to 4.19)
Frequency of chlorine or ethanol based disinfectant use for house cleaning*	–	–	–	–	–
Once in 2 or more days	86 (71.1)	50 (61.7)	36 (90.0)	–	Ref
Once a day or more	35 (28.9)	31 (38.3)	4 (10.0)	0.003	0.18 (0.06 to 0.55)
Ventilation duration per day (hours) (median (IQR))†	2.0 (1.0–6.0)	3.0 (1.5–8.0)	1.8 (1.0–4.0)	–	–
>1	85 (70.2)	62 (76.5)	23 (57.5)	–	Ref
≤1	36 (29.8)	19 (23.5)	17 (42.5)	0.02	2.55 (1.14 to 5.70)

*When cleaning the house, disinfectant which contains chlorine or ethanol is used to disinfect the floor, door and window handles, indoor air, tables and toilets.
†Ventilation means the practice of opening the window to allow convection of indoor air.

Table 4 Risk factors for SARS-CoV-2 household transmission: multivariable analysis

Risk factor	Adjusted OR	95% CI	P value
Primary case has diarrhoea	–	–	–
No	–	–	Ref
Yes	4.10	(1.08 to 15.60)	0.04
Close contact at home with primary cases (within 1 m or 3 feet) (times)	–	–	–
0	–	–	Ref
1–3	3.30	(1.05 to 10.40)	0.04
≥4	18.26	(3.93 to 84.79)	< 0.001
No of family members (including primary case) wearing a mask at home before the primary case's illness onset date	–	–	–
None	–	–	Ref
1 or more	0.21	(0.06 to 0.79)	0.02
Frequency of chlorine or ethanol based disinfectant use for house cleaning	–	–	–
Once in 2 or more days	–	–	Ref
Once a day or more	0.23	(0.07 to 0.84)	0.03

hygiene alone did not protect against respiratory transmissible viruses, but masks combined with hand hygiene did have effect.[16]

As the compliance of UFMU would be poor in the home, there was difficulty and also no necessity for everyone to wear masks at home. We recommended that those families with members who were at risk of getting infected with SARS-CoV-2 (such as ever having contact with a COVID-19 patient, medical workers caring for a COVID-19 patient or having a history of travelling to high risk areas) should apply UFMU to reduce the risk of household transmission.

This study showed that social distancing within the home is effective and having close contact (within 1 m or 3 feet, such as eating around a table or sitting together watching TV) is a risk factor for transmission. The study also provides evidence of effectiveness of chlorine or ethanol based household disinfection in areas with high community transmission, or where one family member is a health worker, or where there is a risk of COVID-19, such as during home quarantine, consistent with advice provided by local health authorities or organisations.[17] Diarrhoea as a symptom in the primary case is also a risk factor for SARS-CoV-2 transmission within families, which highlights the importance of disinfection of the bathroom and toilet, as well as closing the toilet lid when flushing to prevent aerosolisation of the virus.

Our study has limitations. Telephone interview has inherent limitations, including recall bias. It would take about 20 min to complete an interview, and 95% (118/124) of interviews were rated as informative by the interviewers. The evaluation results of mask wearing were reliable, but we did not collect data on the concentration of disinfectant used by families. The strengths of the study were that we had complete follow-up data and were able to accurately ascertain the incidence of secondary transmission in the cohort.

CONCLUSIONS

Household transmission in the pre-symptomatic or early symptomatic period of COVID-19 is a driver of epidemic growth and any measure aimed at reducing this can flatten the curve. This study reinforces the high risk of transmission in households but importantly shows that UFMU and hygiene measures can significantly reduce the risk of household transmission of COVID-19, independent of household size or crowding. This is the first study to show the effectiveness of precautionary mask use, social distancing and regular disinfection in the household, and can inform guidelines for prevention of household transmission. The results may also be informative for families of high risk groups, such as health workers, quarantined individuals or situations where cases of COVID-19 have to be managed at home.

Author affiliations
[1]Institute for Infectious Disease and Endemic Disease Control, Beijing Center for Disease Prevention and Control, Beijing Research Center for Preventive medicine, Beijing, China
[2]State Key Laboratory of Remote Sensing Science, College of Global Change and Earth System Science, Beijing Normal University, Beijing, China
[3]Office of Beijing Center for Global Health, Beijing Center for Disease Prevention and Control, Beijing Research Center for Preventive medicine, Beijing, China
[4]Institute for nutrition and food hygiene, Beijing Center for Disease Prevention and Control, Beijing Research Center for Preventive medicine, Beijing, China
[5]Department of Environmental and Occupational Health, School of Public Health, University of Nevada, Las Vegas, Nevada, USA
[6]Arizona State University College of Health Solutions, Phoenix, Arizona, USA
[7]Kirby institute, Faculty of Medicine, the University of New South Wales, Sydney, New South Wales, Australia

Acknowledgements We thank the staff members in the district and municipal Centres for Disease Prevention and Control, and medical settings in Beijing for conducting field investigation, specimen collection, laboratory detection and case reporting. We also thank all patients and families involved in the study.

Contributors All authors approved the final draft of the manuscript. The corresponding authors attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Funding This work was supported by Beijing Science and Technology Planning Project (Z201100005420010).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No additional data available.

REFERENCES

1 Tian H, Liu Y, Li Y, *et al*. An investigation of transmission control measures during the first 50 days of the COVID-19 epidemic in China. *Science* 2020;368:638–42.
2 Centers for Disease Control and Prevention. Recommendation regarding the use of cloth face coverings, especially in areas of significant community-based transmission. Available: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html [Accessed 15 Apr 2020].
3 Greenhalgh T, Schmid MB, Czypionka T, *et al*. Face masks for the public during the covid-19 crisis. *BMJ* 2020;369:m1435.
4 Javid B, Weekes MP, Matheso NJ. Covid-19: should the public wear face masks? Yes—population benefits are plausible and harms unlikely. *BMJ* 2020;369:m1442.
5 World Health Organization. Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19), 2020. Available: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report-1100hr-28feb2020-11mar-update.pdf?sfvrsn=1a13fda0_2 [Accessed 15 Apr 2020].
6 Yang HY, Xu J, Li Y, *et al*. [The preliminary analysis on the characteristics of the cluster for the COVID-19]. *Zhonghua Liu Xing Bing Xue Za Zhi* 2020;41:623–8.
7 National Health Commission. New coronavirus pneumonia prevention and control program (5th edition) (in Chinese). Available: http://www.nhc.gov.cn/jkj/s3577/202002/a5d6f7b8c48c451c87dba14889b30147.shtml [Accessed 15 Apr 2020].
8 Zhang YP, The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) — China, 2020. *China CDC Weekly* 2020;2:11322.

9 National Bureau of Statistics. China statistical Yearbook-2019 (in Chinese). Available: http://www.stats.gov.cn/tjsj/ndsj/2019/indexch.htm [Accessed 3 May 2020].
10 Wölfel R, Corman VM, Guggemos W, *et al*. Virological assessment of hospitalized patients with COVID-2019. *Nature* 2020. doi:10.1038/s41586-020-2196-x. [Epub ahead of print: 01 Apr 2020].
11 He X, Lau EHY, Wu P, *et al*. Temporal dynamics in viral shedding and transmissibility of COVID-19. *Nat Med* 2020;26:672–5.
12 Tong Z-D, Tang A, Li K-F, *et al*. Potential presymptomatic transmission of SARS-CoV-2, Zhejiang Province, China, 2020. *Emerg Infect Dis* 2020;26:1052–4.
13 Bai Y, Yao L, Wei T, *et al*. Presumed asymptomatic carrier transmission of COVID-19. *JAMA* 2020. doi:10.1001/jama.2020.2565. [Epub ahead of print: 21 Feb 2020].
14 MacIntyre CR, Cauchemez S, Dwyer DE, *et al*. Face mask use and control of respiratory virus transmission in households. *Emerg Infect Dis* 2009;15:233–41.
15 Cowling BJ, Chan K-H, Fang VJ, *et al*. Facemasks and hand hygiene to prevent influenza transmission in households: a cluster randomized trial. *Ann Intern Med* 2009;151:437–46.
16 Wong VWY, Cowling BJ, Aiello AE. Hand hygiene and risk of influenza virus infections in the community: a systematic review and meta-analysis. *Epidemiol Infect* 2014;142:922–32.
17 Centers for Disease Control and Prevention. Cleaning and disinfection for households: interim recommendations for U.S. households with suspected or confirmed coronavirus disease 2019 (COVID-19). Available: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cleaning-disinfection.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fprepare%2Fcleaning-disinfection.html [Accessed 15 Apr 2020].

BRIEF COMMUNICATION
https://doi.org/10.1038/s41591-020-0843-2
nature medicine

Respiratory virus shedding in exhaled breath and efficacy of face masks

Nancy H. L. Leung[1], Daniel K. W. Chu[1], Eunice Y. C. Shiu[1], Kwok-Hung Chan[2], James J. McDevitt[3], Benien J. P. Hau[1,4], Hui-Ling Yen[1], Yuguo Li[5], Dennis K. M. Ip[1], J. S. Malik Peiris[1], Wing-Hong Seto[1,6], Gabriel M. Leung[1], Donald K. Milton[7,8] and Benjamin J. Cowling[1,8]✉

We identified seasonal human coronaviruses, influenza viruses and rhinoviruses in exhaled breath and coughs of children and adults with acute respiratory illness. Surgical face masks significantly reduced detection of influenza virus RNA in respiratory droplets and coronavirus RNA in aerosols, with a trend toward reduced detection of coronavirus RNA in respiratory droplets. Our results indicate that surgical face masks could prevent transmission of human coronaviruses and influenza viruses from symptomatic individuals.

Respiratory virus infections cause a broad and overlapping spectrum of symptoms collectively referred to as acute respiratory virus illnesses (ARIs) or more commonly the 'common cold'. Although mostly mild, these ARIs can sometimes cause severe disease and death[1]. These viruses spread between humans through direct or indirect contact, respiratory droplets (including larger droplets that fall rapidly near the source as well as coarse aerosols with aerodynamic diameter >5 μm) and fine-particle aerosols (droplets and droplet nuclei with aerodynamic diameter ≤5 μm)[2,3]. Although hand hygiene and use of face masks, primarily targeting contact and respiratory droplet transmission, have been suggested as important mitigation strategies against influenza virus transmission[4], little is known about the relative importance of these modes in the transmission of other common respiratory viruses[2,3,5]. Uncertainties similarly apply to the modes of transmission of COVID-19 (refs. [6,7]).

Some health authorities recommend that masks be worn by ill individuals to prevent onward transmission (source control)[4,8]. Surgical face masks were originally introduced to protect patients from wound infection and contamination from surgeons (the wearer) during surgical procedures, and were later adopted to protect healthcare workers against acquiring infection from their patients. However, most of the existing evidence on the filtering efficacy of face masks and respirators comes from in vitro experiments with nonbiological particles[9,10], which may not be generalizable to infectious respiratory virus droplets. There is little information on the efficacy of face masks in filtering respiratory viruses and reducing viral release from an individual with respiratory infections[8], and most research has focused on influenza[11,12].

Here we aimed to explore the importance of respiratory droplet and aerosol routes of transmission with a particular focus on coronaviruses, influenza viruses and rhinoviruses, by quantifying the amount of respiratory virus in exhaled breath of participants with medically attended ARIs and determining the potential efficacy of surgical face masks to prevent respiratory virus transmission.

Results

We screened 3,363 individuals in two study phases, ultimately enrolling 246 individuals who provided exhaled breath samples (Extended Data Fig. 1). Among these 246 participants, 122 (50%) participants were randomized to not wearing a face mask during the first exhaled breath collection and 124 (50%) participants were randomized to wearing a face mask. Overall, 49 (20%) voluntarily provided a second exhaled breath collection of the alternate type.

Infections by at least one respiratory virus were confirmed by reverse transcription PCR (RT–PCR) in 123 of 246 (50%) participants. Of these 123 participants, 111 (90%) were infected by human (seasonal) coronavirus ($n=17$), influenza virus ($n=43$) or rhinovirus ($n=54$) (Extended Data Figs. 1 and 2), including one participant co-infected by both coronavirus and influenza virus and another two participants co-infected by both rhinovirus and influenza virus. These 111 participants were the focus of our analyses.

There were some minor differences in characteristics of the 111 participants with the different viruses (Table 1a). Overall, 24% of participants had a measured fever ≥37.8 °C, with patients with influenza more than twice as likely than patients infected with coronavirus and rhinovirus to have a measured fever. Coronavirus-infected participants coughed the most with an average of 17 (s.d. = 30) coughs during the 30-min exhaled breath collection. The profiles of the participants randomized to with-mask versus without-mask groups were similar (Supplementary Table 1).

We tested viral shedding (in terms of viral copies per sample) in nasal swabs, throat swabs, respiratory droplet samples and aerosol samples and compared the latter two between samples collected with or without a face mask (Fig. 1). On average, viral shedding was higher in nasal swabs than in throat swabs for each of coronavirus (median 8.1 $\log_{10}$ virus copies per sample versus 3.9), influenza virus (6.7 versus 4.0) and rhinovirus (6.8 versus 3.3), respectively. Viral RNA was identified from respiratory droplets and aerosols for all three viruses, including 30%, 26% and 28% of respiratory droplets and 40%, 35% and 56% of aerosols collected while not wearing a face mask, from coronavirus, influenza virus and rhinovirus-infected participants, respectively (Table 1b). In particular for coronavirus, we identified OC43 and HKU1 from both respiratory

[1]WHO Collaborating Centre for Infectious Disease Epidemiology and Control, School of Public Health, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China. [2]Department of Microbiology, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China. [3]Department of Environmental Health, Harvard School of Public Health, Boston, MA, USA. [4]Department of Surgery, Queen Mary Hospital, Hong Kong, China. [5]Department of Mechanical Engineering, The University of Hong Kong, Hong Kong, China. [6]Department of Pathology, Hong Kong Baptist Hospital, Hong Kong, China. [7]Maryland Institute for Applied Environmental Health, School of Public Health, University of Maryland, College Park, MD, USA. [8]These authors jointly supervised this work: Donald K. Milton, Benjamin J. Cowling. ✉e-mail: bcowling@hku.hk

Table 1a | Characteristics of individuals with symptomatic coronavirus, influenza virus or rhinovirus infection

	All who provided exhaled breath	Coronavirus	Influenza virus	Rhinovirus
	(*n* = 246)	(*n* = 17)	(*n* = 43)	(*n* = 54)
	n (%)	*n* (%)	*n* (%)	*n* (%)
Female	144 (59)	13 (76)	22 (51)	30 (56)
Age group, years				
11–17	12 (5)	0 (0)	8 (19)	4 (7)
18–34	114 (46)	10 (59)	11 (26)	24 (44)
35–50	79 (32)	2 (12)	16 (37)	18 (33)
51–64	35 (14)	4 (24)	8 (19)	5 (9)
≥ 65	6 (2)	1 (6)	0 (0)	3 (6)
Chronic medical conditions				
Any	49 (20)	5 (29)	5 (12)	10 (19)
Respiratory	18 (7)	0 (0)	4 (9)	3 (6)
Influenza vaccination				
Ever	94 (38)	6 (35)	15 (35)	20 (37)
Current season	23 (9)	2 (12)	1 (2)	4 (7)
Previous season only	71 (29)	4 (24)	14 (33)	16 (30)
Ever smoker	31 (13)	1 (6)	6 (14)	6 (11)
Time since illness onset, h				
<24	22 (9)	0 (0)	5 (12)	2 (4)
24–48	100 (41)	9 (53)	13 (30)	25 (46)
48–72	85 (35)	8 (47)	18 (42)	20 (37)
72–96	39 (16)	0 (0)	7 (16)	7 (13)
History of measured fever ≥37.8 °C	58 (24)	3 (18)	17 (40)	8 (15)
Measured fever ≥37.8 °C at presentation	36 (15)	2 (12)	18 (42)	2 (4)
Measured body temperature (°C) at enrollment (mean, s.d.)	36.8 (0.8)	36.9 (0.8)	37.4 (0.9)	36.6 (0.7)
Symptoms at presentation				
Fever	111 (45)	10 (59)	27 (63)	16 (30)
Cough	198 (80)	15 (88)	40 (93)	44 (81)
Sore throat	211 (86)	15 (88)	31 (72)	49 (91)
Runny nose	200 (81)	17 (100)	36 (84)	48 (89)
Headache	186 (76)	13 (76)	30 (70)	38 (70)
Myalgia	176 (72)	12 (71)	31 (72)	34 (63)
Phlegm	176 (72)	9 (53)	34 (79)	41 (76)
Chest tightness	64 (26)	3 (18)	12 (28)	9 (17)
Shortness of breath	103 (42)	6 (35)	14 (33)	25 (46)
Chills	100 (41)	8 (47)	29 (67)	16 (30)
Sweating	95 (39)	5 (29)	18 (42)	20 (37)
Fatigue	218 (89)	16 (94)	38 (88)	48 (89)
Vomiting	19 (8)	2 (12)	5 (12)	2 (4)
Diarrhea	17 (7)	2 (12)	1 (2)	6 (11)
Number of coughs during exhaled breath collection (mean, s.d.)	8 (14)	17 (30)	8 (11)	5 (9)

Seasonal coronavirus (*n* = 17), seasonal influenza virus (*n* = 43) and rhinovirus (*n* = 54) infections were confirmed in individuals with acute respiratory symptoms by RT–PCR in any samples (nasal swab, throat swab, respiratory droplets and aerosols) collected.

droplets and aerosols, but only identified NL63 from aerosols and not from respiratory droplets (Supplementary Table 2 and Extended Data Fig. 3).

We detected coronavirus in respiratory droplets and aerosols in 3 of 10 (30%) and 4 of 10 (40%) of the samples collected without face masks, respectively, but did not detect any virus in respiratory droplets or aerosols collected from participants wearing face masks, this difference was significant in aerosols and showed a trend toward reduced detection in respiratory droplets (Table 1b). For influenza virus, we detected virus in 6 of 23 (26%) and 8 of 23 (35%) of the

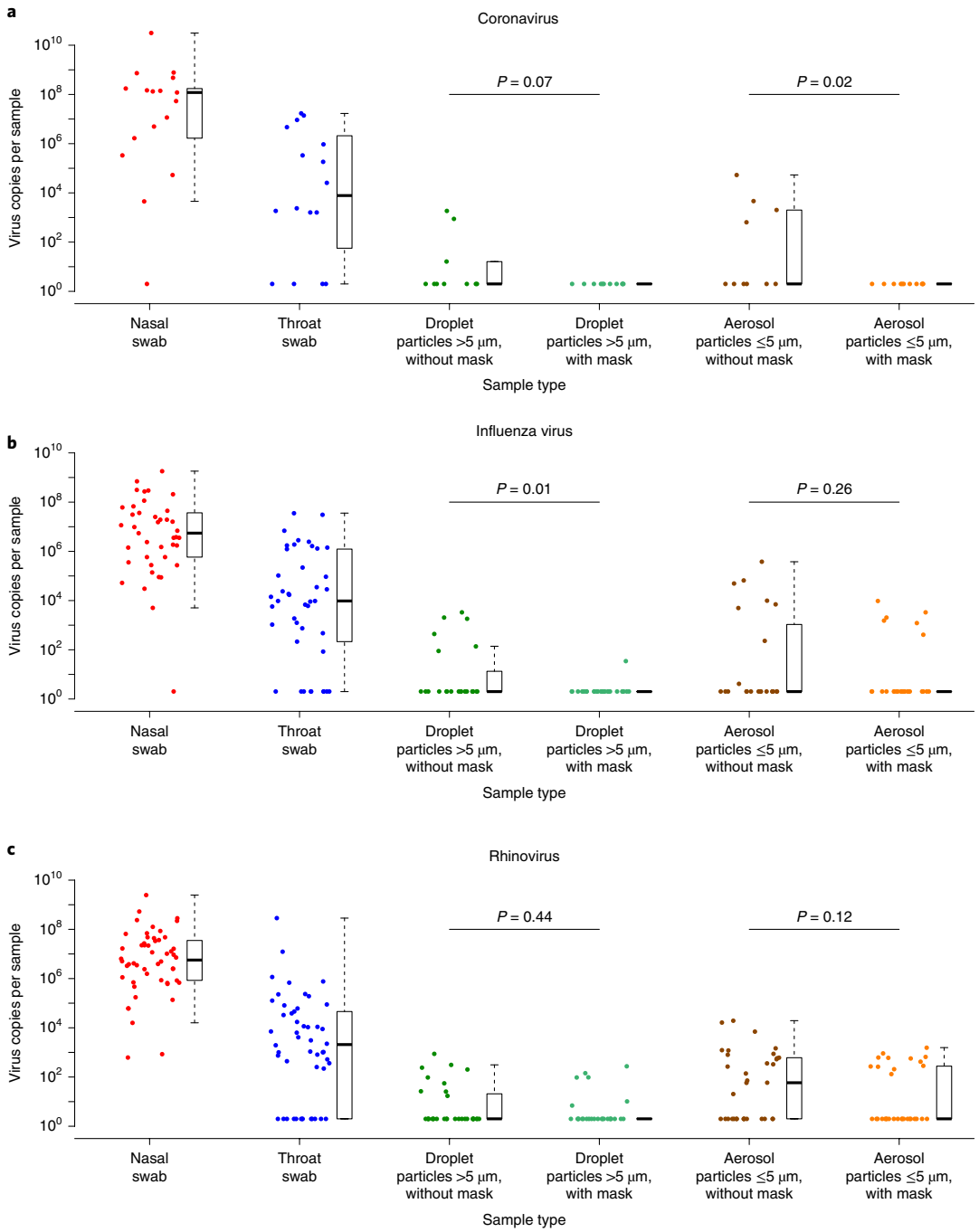


Fig. 1 | Efficacy of surgical face masks in reducing respiratory virus shedding in respiratory droplets and aerosols of symptomatic individuals with coronavirus, influenza virus or rhinovirus infection. a–**c**, Virus copies per sample collected in nasal swab (red), throat swab (blue) and respiratory droplets collected for 30min while not wearing (dark green) or wearing (light green) a surgical face mask, and aerosols collected for 30min while not wearing (brown) or wearing (orange) a face mask, collected from individuals with acute respiratory symptoms who were positive for coronavirus (**a**), influenza virus (**b**) and rhinovirus (**c**), as determined by RT–PCR in any samples. *P* values for mask intervention as predictor of $\log_{10}$ virus copies per sample in an unadjusted univariate Tobit regression model which allowed for censoring at the lower limit of detection of the RT–PCR assay are shown, with significant differences in bold. For nasal swabs and throat swabs, all infected individuals were included (coronavirus, *n*=17; influenza virus, *n*=43; rhinovirus, *n*=54). For respiratory droplets and aerosols, numbers of infected individuals who provided exhaled breath samples while not wearing or wearing a surgical face mask, respectively were: coronavirus (*n*=10 and 11), influenza virus (*n*=23 and 28) and rhinovirus (*n*=36 and 32). A subset of participants provided exhaled breath samples for both mask interventions (coronavirus, *n*=4; influenza virus, *n*=8; rhinovirus, *n*=14). The box plots indicate the median with the interquartile range (lower and upper hinge) and ±1.5×interquartile range from the first and third quartile (lower and upper whiskers).

Table 1b | Efficacy of surgical face masks in reducing respiratory virus frequency of detection and viral shedding in respiratory droplets and aerosols of symptomatic individuals with coronavirus, influenza virus or rhinovirus infection

	Droplet particles >5 µm			Aerosol particles ≤5 µm		
Virus type	**Without surgical face mask**	**With surgical face mask**	***P***	**Without surgical face mask**	**With surgical face mask**	***P***
	Detection of virus					
	No. positive/no. total (%)	**No. positive/no. total (%)**		**No. positive/no. total (%)**	**No. positive/no. total (%)**	
Coronavirus	3 of 10 (30)	0 of 11 (0)	0.09	**4 of 10 (40)**	**0 of 11 (0)**	**0.04**
Influenza virus	**6 of 23 (26)**	**1 of 27 (4)**	**0.04**	8 of 23 (35)	6 of 27 (22)	0.36
Rhinovirus	9 of 32 (28)	6 of 27 (22)	0.77	19 of 34 (56)	12 of 32 (38)	0.15
	Viral load (log_{10} virus copies per sample)					
	Median (IQR)	**Median (IQR)**		**Median (IQR)**	**Median (IQR)**	
Coronavirus	0.3 (0.3, 1.2)	0.3 (0.3, 0.3)	0.07	**0.3 (0.3, 3.3)**	**0.3 (0.3, 0.3)**	**0.02**
Influenza virus	**0.3 (0.3, 1.1)**	**0.3 (0.3, 0.3)**	**0.01**	0.3 (0.3, 3.0)	0.3 (0.3, 0.3)	0.26
Rhinovirus	0.3 (0.3, 1.3)	0.3 (0.3, 0.3)	0.44	1.8 (0.3, 2.8)	0.3 (0.3, 2.4)	0.12

P values for comparing the frequency of respiratory virus detection between the mask intervention were obtained by two-sided Fisher's exact test and (two-sided) *P* values for mask intervention as predictor of log_{10} virus copies per sample were obtained by an unadjusted univariate Tobit regression model, which allowed for censoring at the lower limit of detection of the RT–PCR assay, with significant differences in bold. Undetectable values were imputed as 0.3 log_{10} virus copies per sample. IQR, interquartile range.

respiratory droplet and aerosol samples collected without face masks, respectively. There was a significant reduction by wearing face masks to 1 of 27 (4%) in detection of influenza virus in respiratory droplets, but no significant reduction in detection in aerosols (Table 1b). Moreover, among the eight participants who had influenza virus detected by RT–PCR from without-mask aerosols, five were tested by viral culture and four were culture-positive. Among the six participants who had influenza virus detected by RT–PCR from with-mask aerosols, four were tested by viral culture and two were culture-positive. For rhinovirus, there were no significant differences between detection of virus with or without face masks, both in respiratory droplets and in aerosols (Table 1b). Conclusions were similar in comparisons of viral shedding (Table 1b). In addition, we found a significant reduction in viral shedding (Supplementary Table 2) in respiratory droplets for OC43 (Extended Data Fig. 4) and influenza B virus (Extended Data Fig. 5) and in aerosols for NL63 (Extended Data Fig. 4).

We identified correlations between viral loads in different samples (Extended Data Figs. 6–8) and some evidence of declines in viral shedding by time since onset for influenza virus but not for coronavirus or rhinovirus (Extended Data Fig. 9). In univariable analyses of factors associated with detection of respiratory viruses in various sample types, we did not identify significant association in viral shedding with days since symptom onset (Supplementary Table 3) for respiratory droplets or aerosols (Supplementary Tables 4–6).

A subset of participants (72 of 246, 29%) did not cough at all during at least one exhaled breath collection, including 37 of 147 (25%) during the without-mask and 42 of 148 (28%) during the with-mask breath collection. In the subset for coronavirus ($n=4$), we did not detect any virus in respiratory droplets or aerosols from any participants. In the subset for influenza virus ($n=9$), we detected virus in aerosols but not respiratory droplets from one participant. In the subset for rhinovirus ($n=17$), we detected virus in respiratory droplets from three participants, and we detected virus in aerosols in five participants.

Discussion

Our results indicate that aerosol transmission is a potential mode of transmission for coronaviruses as well as influenza viruses and rhinoviruses. Published studies detected respiratory viruses[13,14] such as influenza[12,15] and rhinovirus[16] from exhaled breath, and the detection of SARS-CoV[17] and MERS-CoV[18] from air samples (without size fractionation) collected from hospitals treating patients with severe acute respiratory syndrome and Middle East respiratory syndrome, but ours demonstrates detection of human seasonal coronaviruses in exhaled breath, including the detection of OC43 and HKU1 from respiratory droplets and NL63, OC43 and HKU1 from aerosols.

Our findings indicate that surgical masks can efficaciously reduce the emission of influenza virus particles into the environment in respiratory droplets, but not in aerosols[12]. Both the previous and current study used a bioaerosol collecting device, the Gesundheit-II (G-II)[12,15,19], to capture exhaled breath particles and differentiated them into two size fractions, where exhaled breath coarse particles >5 µm (respiratory droplets) were collected by impaction with a 5-µm slit inertial Teflon impactor and the remaining fine particles ≤5 µm (aerosols) were collected by condensation in buffer. We also demonstrated the efficacy of surgical masks to reduce coronavirus detection and viral copies in large respiratory droplets and in aerosols (Table 1b). This has important implications for control of COVID-19, suggesting that surgical face masks could be used by ill people to reduce onward transmission.

Among the samples collected without a face mask, we found that the majority of participants with influenza virus and coronavirus infection did not shed detectable virus in respiratory droplets or aerosols, whereas for rhinovirus we detected virus in aerosols in 19 of 34 (56%) participants (compared to 4 of 10 (40%) for coronavirus and 8 of 23 (35%) for influenza). For those who did shed virus in respiratory droplets and aerosols, viral load in both tended to be low (Fig. 1). Given the high collection efficiency of the G-II (ref. [19]) and given that each exhaled breath collection was conducted for 30 min, this might imply that prolonged close contact would be required for transmission to occur, even if transmission was primarily via aerosols, as has been described for rhinovirus colds[20]. Our results also indicate that there could be considerable heterogeneity in contagiousness of individuals with coronavirus and influenza virus infections.

The major limitation of our study was the large proportion of participants with undetectable viral shedding in exhaled breath for each of the viruses studied. We could have increased the sampling duration beyond 30 min to increase the viral shedding being captured, at the cost of acceptability in some participants. An alternative approach would be to invite participants to perform forced coughs during exhaled breath collection[12]. However, it was the aim of our present study to focus on recovering respiratory

virus in exhaled breath in a real-life situation and we expected that some individuals during an acute respiratory illness would not cough much or at all. Indeed, we identified virus RNA in a small number of participants who did not cough at all during the 30-min exhaled breath collection, which would suggest droplet and aerosol routes of transmission are possible from individuals with no obvious signs or symptoms. Another limitation is that we did not confirm the infectivity of coronavirus or rhinovirus detected in exhaled breath. While the G-II was designed to preserve viability of viruses in aerosols, and in the present study we were able to identify infectious influenza virus in aerosols, we did not attempt to culture coronavirus or rhinovirus from the corresponding aerosol samples.

Online content

Any methods, additional references, Nature Research reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at https://doi.org/10.1038/s41591-020-0843-2.

Received: 2 March 2020; Accepted: 20 March 2020;
Published online: 3 April 2020

References

1. Nichols, W. G., Peck Campbell, A. J. & Boeckh, M. Respiratory viruses other than influenza virus: impact and therapeutic advances. *Clin. Microbiol. Rev.* **21**, 274–290 (2008).
2. Shiu, E. Y. C., Leung, N. H. L. & Cowling, B. J. Controversy around airborne versus droplet transmission of respiratory viruses: implication for infection prevention. *Curr. Opin. Infect. Dis.* **32**, 372–379 (2019).
3. Tellier, R., Li, Y., Cowling, B. J. & Tang, J. W. Recognition of aerosol transmission of infectious agents: a commentary. *BMC Infect. Dis.* **19**, 101 (2019).
4. Xiao, J. et al. Nonpharmaceutical measures for pandemic influenza in nonhealthcare settings-personal protective and environmental measures. *Emerg. Infect. Dis.* https://doi.org/10.3201/eid2605.190994 (2020).
5. Kutter, J. S., Spronken, M. I., Fraaij, P. L., Fouchier, R. A. M. & Herfst, S. Transmission routes of respiratory viruses among humans. *Curr. Opin. Virol.* **28**, 142–151 (2018).
6. Cowling, B. J. & Leung, G. M. Epidemiological research priorities for public health control of the ongoing global novel coronavirus (2019-nCoV) outbreak. *Euro Surveill.* https://doi.org/10.2807/1560-7917.ES.2020.25.6.2000110 (2020).
7. Han, Q., Lin, Q., Ni, Z. & You, L. Uncertainties about the transmission routes of 2019 novel coronavirus. *Influenza Other Respir. Viruses* https://doi.org/10.1111/irv.12735 (2020).
8. MacIntyre, C. R. & Chughtai, A. A. Facemasks for the prevention of infection in healthcare and community settings. *BMJ* **350**, h694 (2015).
9. Ha'eri, G. B. & Wiley, A. M. The efficacy of standard surgical face masks: an investigation using "tracer particles". *Clin. Orthop. Relat. Res.* **148**, 160–162 (1980).
10. Patel, R. B., Skaria, S. D., Mansour, M. M. & Smaldone, G. C. Respiratory source control using a surgical mask: an in vitro study. *J. Occup. Environ. Hyg.* **13**, 569–576 (2016).
11. Johnson, D. F., Druce, J. D., Birch, C. & Grayson, M. L. A quantitative assessment of the efficacy of surgical and N95 masks to filter influenza virus in patients with acute influenza infection. *Clin. Infect. Dis.* **49**, 275–277 (2009).
12. Milton, D. K., Fabian, M. P., Cowling, B. J., Grantham, M. L. & McDevitt, J. J. Influenza virus aerosols in human exhaled breath: particle size, culturability, and effect of surgical masks. *PLoS Pathog.* **9**, e1003205 (2013).
13. Huynh, K. N., Oliver, B. G., Stelzer, S., Rawlinson, W. D. & Tovey, E. R. A new method for sampling and detection of exhaled respiratory virus aerosols. *Clin. Infect. Dis.* **46**, 93–95 (2008).
14. Stelzer-Braid, S. et al. Exhalation of respiratory viruses by breathing, coughing and talking. *J. Med. Virol.* **81**, 1674–1679 (2009).
15. Yan, J. et al. Infectious virus in exhaled breath of symptomatic seasonal influenza cases from a college community. *Proc. Natl Acad. Sci. USA* **115**, 1081–1086 (2018).
16. Tovey, E. R. et al. Rhinoviruses significantly affect day-to-day respiratory symptoms of children with asthma. *J. Allergy Clin. Immunol.* **135**, 663–669 (2015).
17. Booth, T. F. et al. Detection of airborne severe acute respiratory syndrome (SARS) coronavirus and environmental contamination in SARS outbreak units. *J. Infect. Dis.* **191**, 1472–1477 (2005).
18. Kim, S. H. et al. Extensive viable Middle East respiratory syndrome (MERS) coronavirus contamination in air and surrounding environment in MERS isolation wards. *Clin. Infect. Dis.* **63**, 363–369 (2016).
19. McDevitt, J. J. et al. Development and performance evaluation of an exhaled-breath bioaerosol collector for influenza virus. *Aerosol Sci. Technol.* **47**, 444–451 (2013).
20. Jennings, L. C. & Dick, E. C. Transmission and control of rhinovirus colds. *Eur. J. Epidemiol.* **3**, 327–335 (1987).

Methods

Study design. Participants were recruited year-round from March 2013 through May 2016 in a general outpatient clinic of a private hospital in Hong Kong. As routine practice, clinic staff screened all individuals attending the clinics for respiratory and any other symptoms regardless of the purpose of the visit at triage. Study staff then approached immediately those who reported at least one of the following symptoms of ARI for further screening: fever ≥37.8 °C, cough, sore throat, runny nose, headache, myalgia and phlegm. Individuals who reported ≥2 ARI symptoms, within 3 d of illness onset and ≥11 years of age were eligible to participate. After explaining the study to and obtaining informed consent from the participants, a rapid influenza diagnostic test, the Sofia Influenza A + B Fluorescent Immunoassay Analyzer (cat. no. 20218, Quidel), was used to identify influenza A or B virus infection as an incentive to participate. All participants provided a nasal swab for the rapid test and an additional nasal swab and a separate throat swab for subsequent virologic confirmation at the laboratory. All participants also completed a questionnaire to record basic information including age, sex, symptom severity, medication, medical conditions and smoking history. In the first phase of the study from March 2013 to February 2014 ('Influenza Study'), the result of the rapid test was used to determine eligibility for further participation in the study and exhaled breath collection, whereas in the second phase of the study from March 2014 to May 2016 ('Respiratory Virus Study'), the rapid test did not affect eligibility. Eligible participants were then invited to provide an exhaled breath sample for 30 min in the same clinic visit.

Before exhaled breath collection, each participant was randomly allocated in a 1:1 ratio to either wearing a surgical face mask (cat. no. 62356, Kimberly-Clark) or not during the collection. To mimic the real-life situation, under observation by the study staff, participants were asked to attach the surgical mask themselves, but instruction on how to wear the mask properly was given when the participant wore the mask incorrectly. Participants were instructed to breathe as normal during the collection, but (natural) coughing was allowed and the number of coughs was recorded by study staff. Participants were then invited to provide a second exhaled breath sample of the alternate type (for example if the participant was first assigned to wearing a mask they would then provide a second sample without a mask), but most participants did not agree to stay for a second measurement because of time constraints. Participants were compensated for each 30-min exhaled breath collection with a supermarket coupon worth approximately US$30 and all participants were gifted a tympanic thermometer worth approximately US$20.

Ethical approval. Written informed consent was obtained from all participants ≥18 years of age and written informed consent was obtained from parents or legal guardians of participants 11–17 years of age in addition to their own written informed consent. The study protocol was approved by the Institutional Review Board of The University of Hong Kong and the Clinical and Research Ethics Committee of Hong Kong Baptist Hospital.

Collection of swabs and exhaled breath particles. Nasal swabs and throat swabs were collected separately, placed in virus transport medium, stored and transported to the laboratory at 2–8 °C and the virus transport medium was aliquoted and stored at −70 °C until further analysis. Exhaled breath particles were captured and differentiated into two size fractions, the coarse fraction containing particles with aerodynamic diameter >5 µm (referred to here as 'respiratory droplets'), which included droplets up to approximately 100 µm in diameter and the fine fraction with particles ≤5 µm (referred to here as 'aerosols') by the G-II bioaerosol collecting device[12,15,19]. In the G-II device, exhaled breath coarse particles >5 µm were collected by a 5-µm slit inertial Teflon impactor and the remaining fine particles ≤5 µm were condensed and collected into approximately 170 ml of 0.1% BSA/PBS. Both the impactor and the condensate were stored and transported to the laboratory at 2–8 °C. The virus on the impactor was recovered into 1 ml and the condensate was concentrated into 2 ml of 0.1% BSA/PBS, aliquoted and stored at −70 °C until further analysis. In a validation study, the G-II was able to recover over 85% of fine particles >0.05 µm in size and had comparable collection efficiency of influenza virus as the SKC BioSampler[19].

Laboratory testing. Samples collected from the two studies were tested at the same time. Nasal swab samples were first tested by a diagnostic-use viral panel, xTAG Respiratory Viral Panel (Abbott Molecular) to qualitatively detect 12 common respiratory viruses and subtypes including coronaviruses (NL63, OC43, 229E and HKU1), influenza A (nonspecific, H1 and H3) and B viruses, respiratory syncytial virus, parainfluenza virus (types 1–4), adenovirus, human metapneumovirus and enterovirus/rhinovirus. After one or more of the candidate respiratory viruses was detected by the viral panel from the nasal swab, all the samples from the same participant (nasal swab, throat swab, respiratory droplets and aerosols) were then tested with RT–PCR specific for the candidate virus(es) for determination of virus concentration in the samples. Infectious influenza virus was identified by viral culture using MDCK cells as described previously[21], whereas viral culture was not performed for coronavirus and rhinovirus.

Statistical analyses. The primary outcome of the study was virus generation rate in tidal breathing of participants infected by different respiratory viruses and the efficacy of face masks in preventing virus dissemination in exhaled breath, separately considering the respiratory droplets and aerosols. The secondary outcomes were correlation between viral shedding in nose swabs, throat swabs, respiratory droplets and aerosols and factors affecting viral shedding in respiratory droplets and aerosols.

We identified three groups of respiratory viruses with the highest frequency of infection as identified by RT–PCR, namely coronavirus (including NL63, OC43, HKU1 and 229E), influenza virus and rhinovirus, for further statistical analyses. We defined viral shedding as $\log_{10}$ virus copies per sample and plotted viral shedding in each sample (nasal swab, throat swab, respiratory droplets and aerosols); the latter two were stratified by mask intervention. As a proxy for the efficacy of face masks in preventing transmission of respiratory viruses via respiratory droplet and aerosol routes, we compared the respiratory virus viral shedding in respiratory droplet and aerosol samples between participants wearing face masks or not, by comparing the frequency of detection with a two-sided Fisher's exact test and by comparing viral load (defined as $\log_{10}$ virus copies per sample) by an unadjusted univariate Tobit regression model, which allowed for censoring at the lower limit of detection of the RT–PCR assay. We also used the unadjusted univariate Tobit regression to investigate factors affecting viral shedding in respiratory droplets and aerosols without mask use, for example age, days since symptom onset, previous influenza vaccination, current medication and number of coughs during exhaled breath collection. We investigated correlations between viral shedding in nasal swab, throat swab, respiratory droplets and aerosols with scatter-plots and calculated the Spearman's rank correlation coefficient between any two types of samples. We imputed 0.3 $\log_{10}$ virus copies ml^{-1} for undetectable values before transformation to $\log_{10}$ virus copies per sample. All analyses were conducted with R v.3.6.0 (ref. [22]) and the VGAM package v.1.1.1 (ref. [23]).

Reporting Summary. Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability

Anonymized raw data and R syntax to reproduce all the analyses, figures, tables and supplementary tables in the published article are available at: https://doi.org/10.5061/dryad.w9ghx3fkt.

References

21. Chan, K. H., Peiris, J. S., Lim, W., Nicholls, J. M. & Chiu, S. S. Comparison of nasopharyngeal flocked swabs and aspirates for rapid diagnosis of respiratory viruses in children. *J. Clin. Virol.* **42**, 65–69 (2008).
22. R: a language and environment for statistical computing (R Foundation for Statistical Computing, Vienna, Austria, 2019).
23. Yee, T. W. *Vector Generalized Linear and Additive Models: with an Implementation in R* (Springer, 2016).

Acknowledgements

This work was supported by the General Research Fund of the University Grants Committee (grant no. 765811), the Health and Medical Research Fund (grant no. 13120592) and a commissioned grant of the Food and Health Bureau and the Theme-based Research Scheme (project no. T11-705/14-N) of the Research Grants Council of the Hong Kong SAR Government. We acknowledge colleagues including R. O. P. Fung, A. K. W. Li, T. W. Y. Ng, T. H. C. So, P. Wu and Y. Xie for technical support in preparing and conducting this study and enrolling participants; J. K. M. Chan, S. Y. Ho, Y. Z. Liu and A. Yu for laboratory support; S. Ferguson, W. K. Leung, J. Pantelic, J. Wei and M. Wolfson for technical support in constructing and maintaining the G-II device; V. J. Fang, L. M. Ho and T. T. K. Lui for setting up the database; and C. W. Y. Cheung, L. F. K. Cheung, P. T. Y. Ching, A. C. H. Lai, D. W. Y. Lam, S. S. Y. Lo, A. S. K. Luk and other colleagues at the Outpatient Center and Infection Control Team of Hong Kong Baptist Hospital for facilitating this study.

Author contributions

All authors meet the International Committee of Medical Journal Editors criteria for authorship. The study protocol was drafted by N.H.L.L. and B.J.C. Data were collected by N.H.L.L., E.Y.C.S. and B.J.P.H. Laboratory testing was performed by D.K.W.C. and K.-H.C. Statistical analyses were conducted by N.H.L.L. N.H.L.L. and B.J.C. wrote the first draft of the manuscript, and all authors provided critical review and revision of the text and approved the final version.

Competing interests

B.J.C. consults for Roche and Sanofi Pasteur. The authors declare no other competing interests.

Additional information

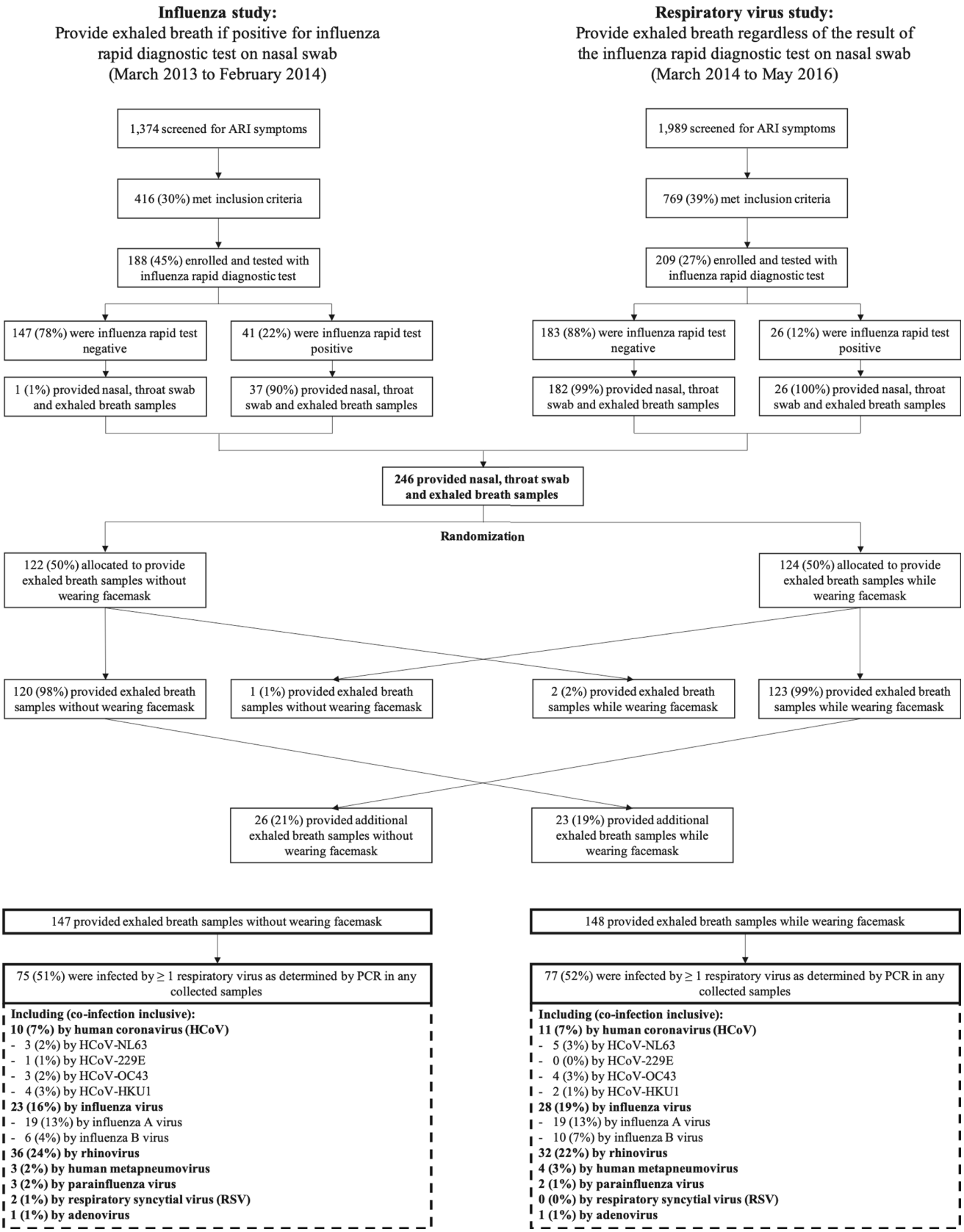
Extended data is available for this paper at https://doi.org/10.1038/s41591-020-0843-2.

Supplementary information is available for this paper at https://doi.org/10.1038/s41591-020-0843-2.

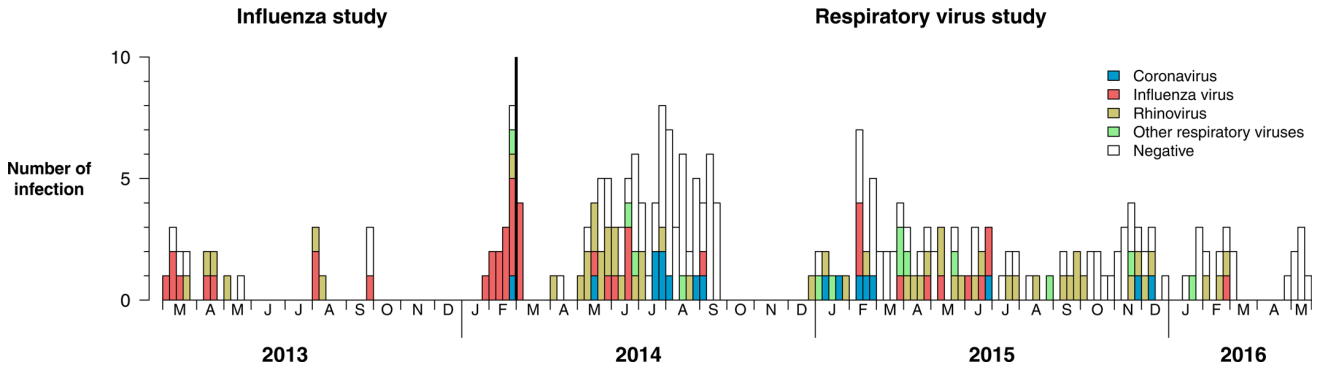
Correspondence and requests for materials should be addressed to B.J.C.

Peer review information Alison Farrell was the primary editor on this article and managed its editorial process and peer review in collaboration with the rest of the editorial team.

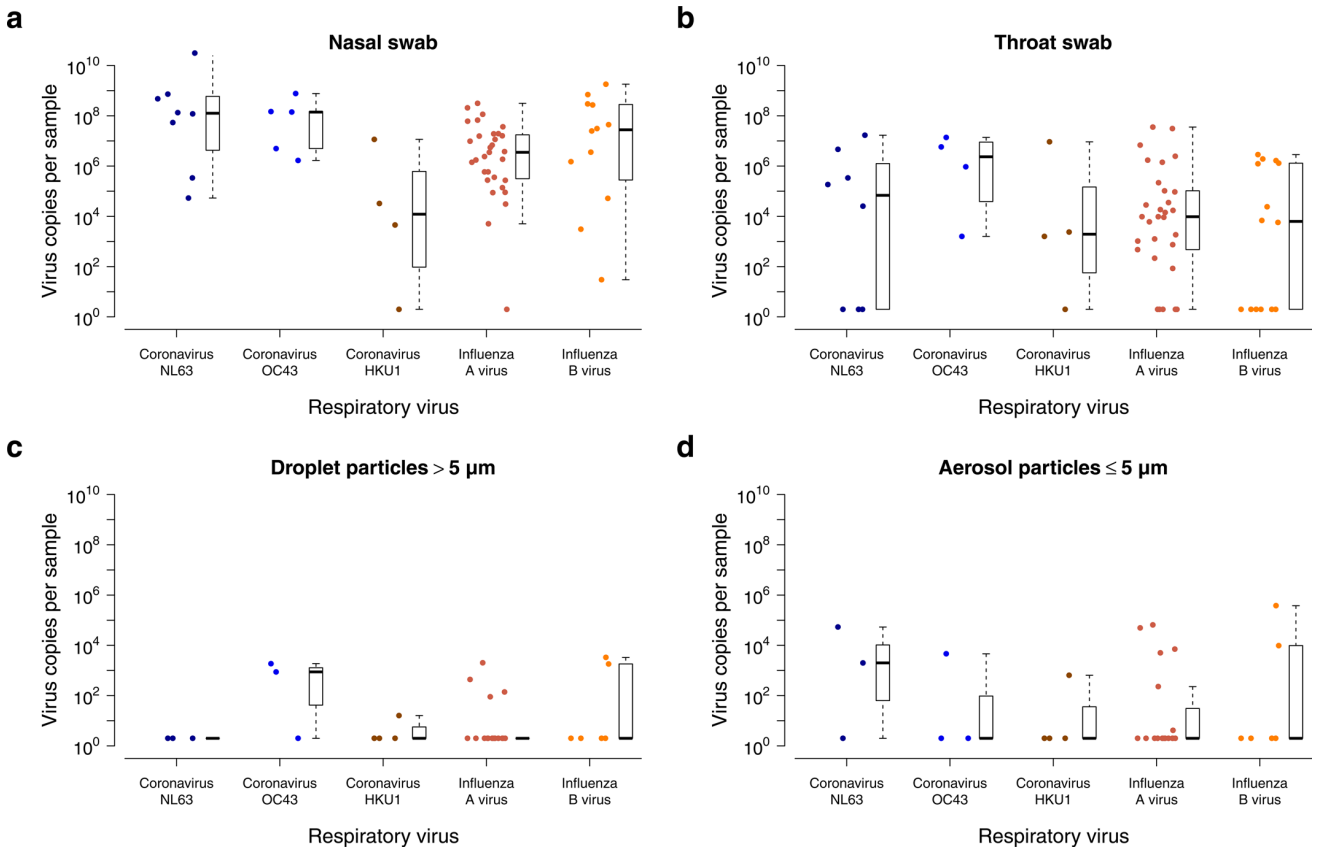
Reprints and permissions information is available at www.nature.com/reprints.



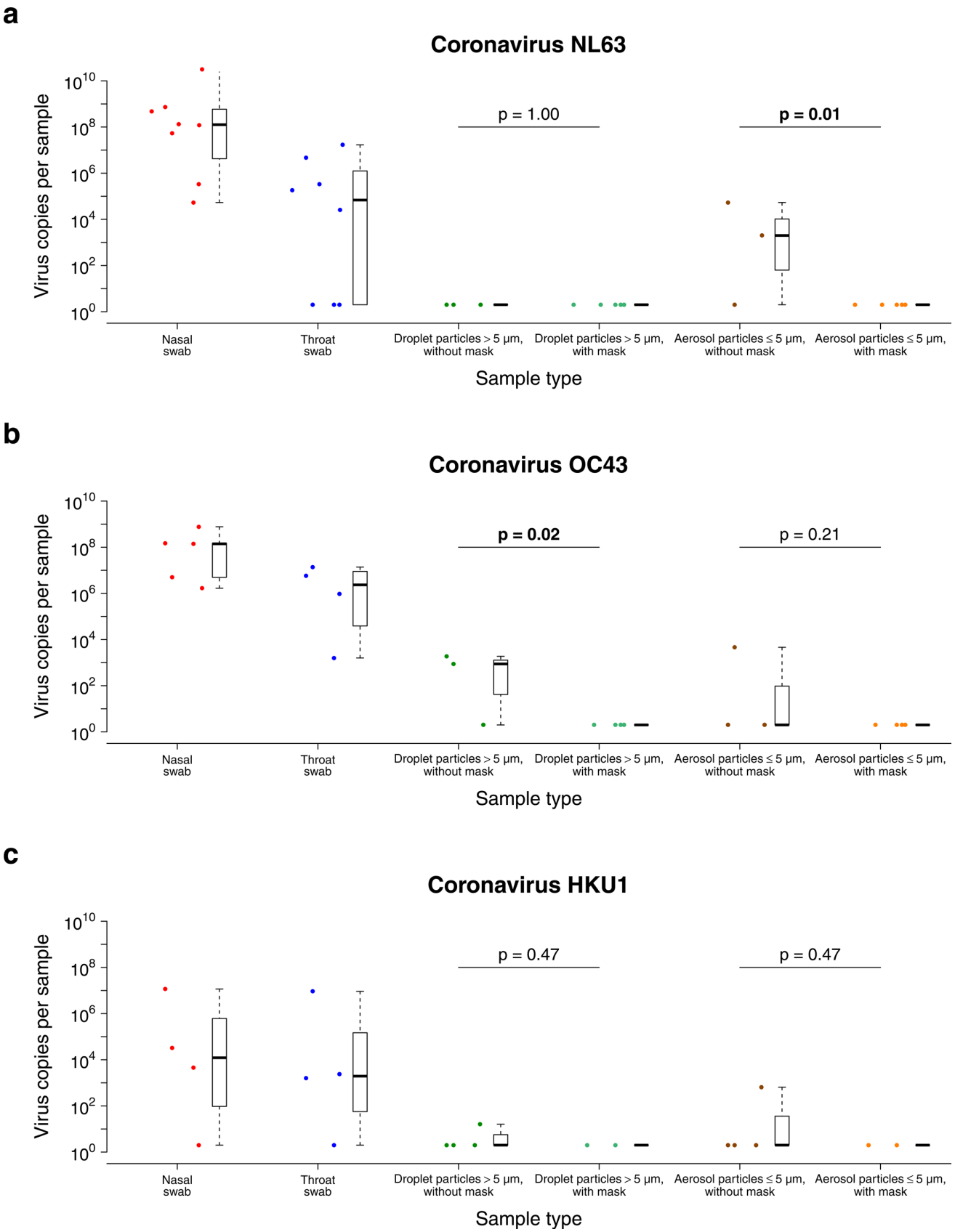
Extended Data Fig. 1 | Participant enrolment, randomization of mask intervention and identification of respiratory virus infection.



Extended Data Fig. 2 | Weekly number of respiratory virus infections identified by RT-PCR in symptomatic individuals who had provided exhaled breath samples (respiratory droplets and aerosols) during the study period. Blue, coronavirus; red, influenza virus; yellow, rhinovirus; green, other respiratory viruses including human metapneumovirus, parainfluenza virus, respiratory syncytial virus and adenovirus; white, no respiratory virus infection identified.

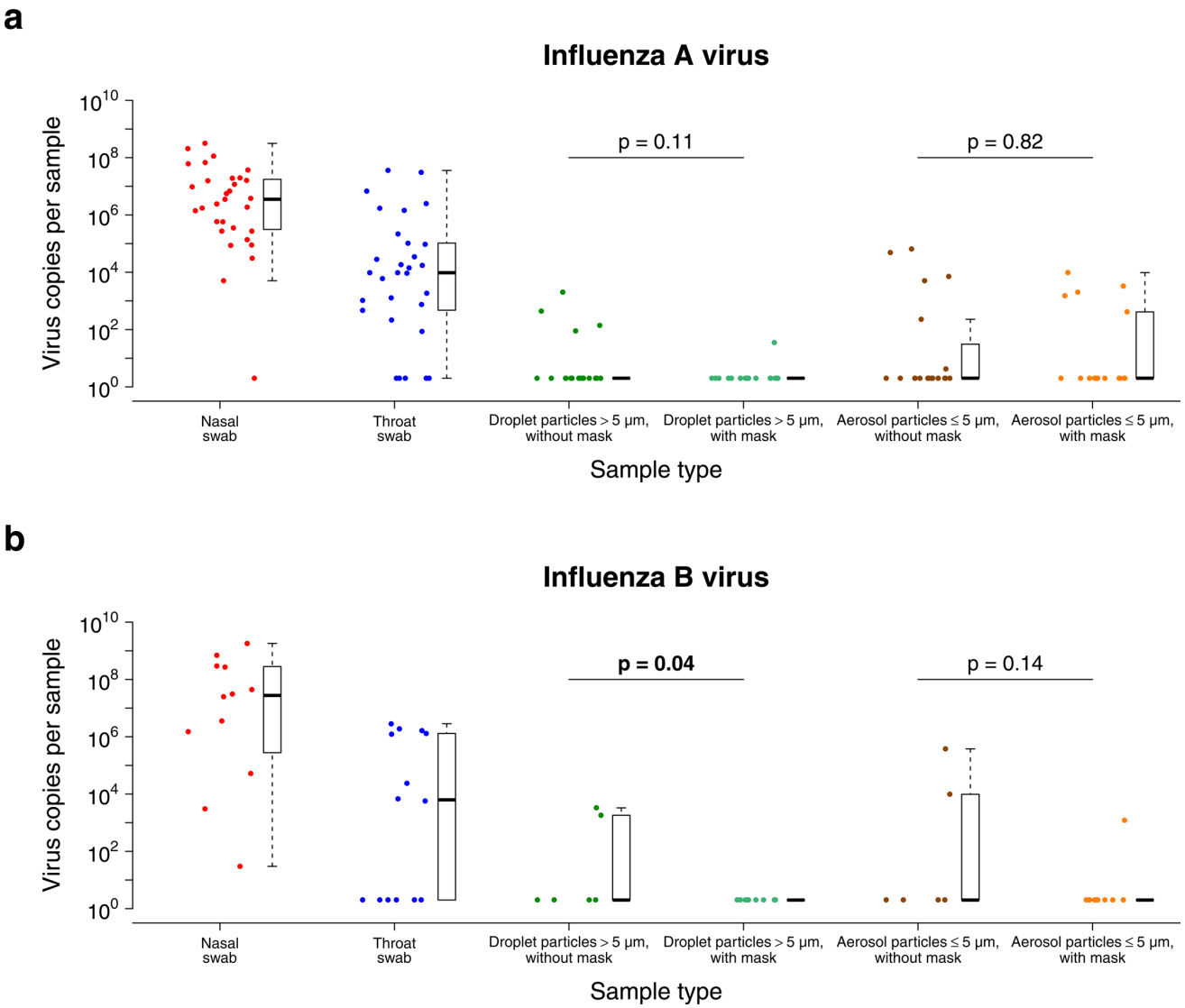


Extended Data Fig. 3 | Respiratory virus shedding in (a) nasal swab, (b) throat swab, (c) respiratory droplets and (d) aerosols in symptomatic individuals with coronavirus NL63, coronavirus OC43, coronavirus HKU1, influenza A and influenza B virus infection. For nasal swabs and throat swabs, all infected individuals identified by RT-PCR in any collected samples were included: coronavirus NL63 (n = 8), coronavirus OC43 (n = 5), coronavirus HKU1 (n = 4), influenza A virus (n = 31) and influenza B virus (n = 14). For respiratory droplets and aerosols, only infected individuals who provided exhaled breath samples while not wearing a surgical face mask were included: coronavirus NL63 (n = 3), coronavirus OC43 (n = 3), coronavirus HKU1 (n = 4), influenza A virus (n = 19) and influenza B virus (n = 6). The box plots indicate the median with the interquartile range (lower and upper hinge) and ±1.5 × interquartile range from the first and third quartile (lower and upper whisker). Dark blue, coronavirus NL63; light blue, coronavirus OC43; brown, coronavirus HKU1; red, influenza A virus; orange, influenza B virus.

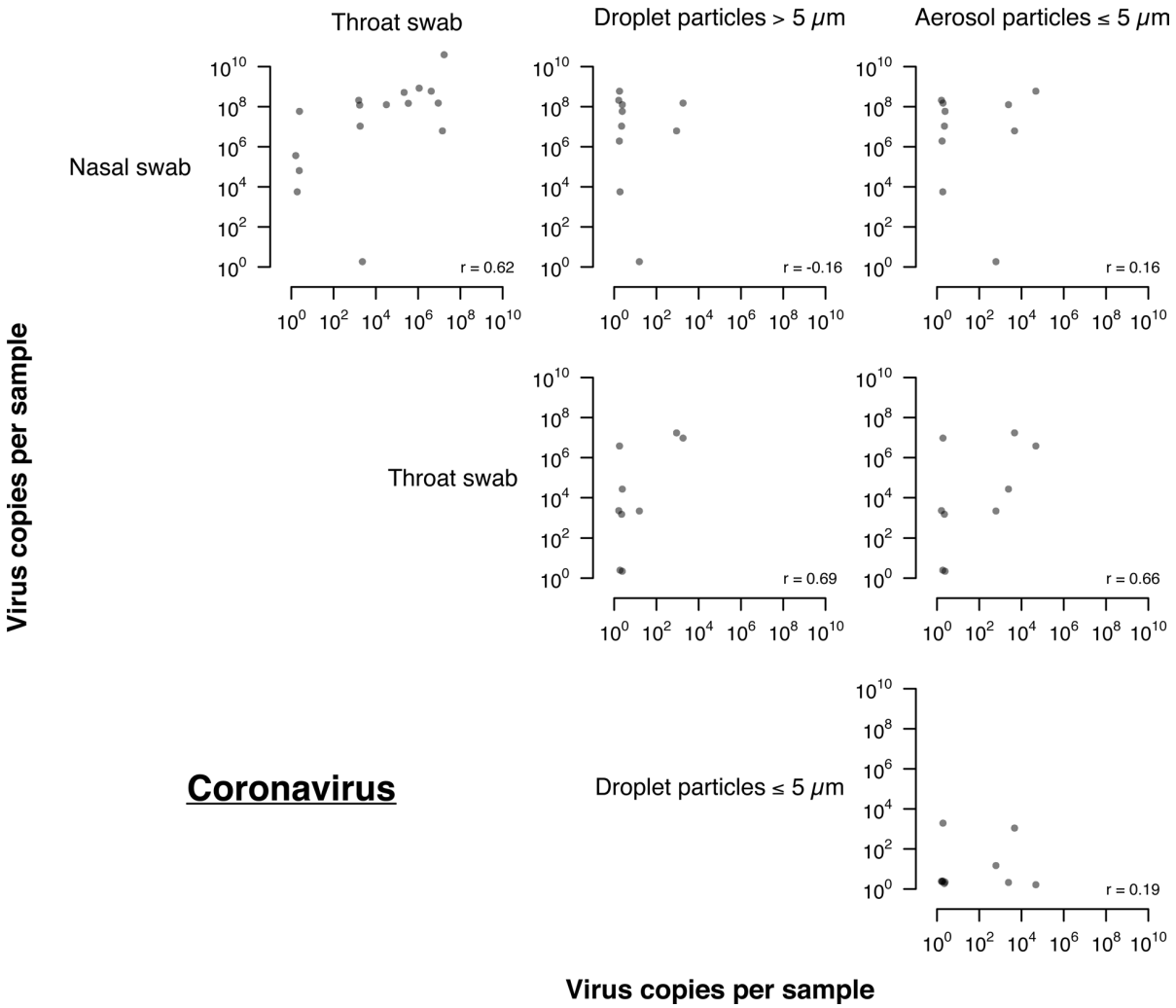


Extended Data Fig. 4 | See next page for caption.

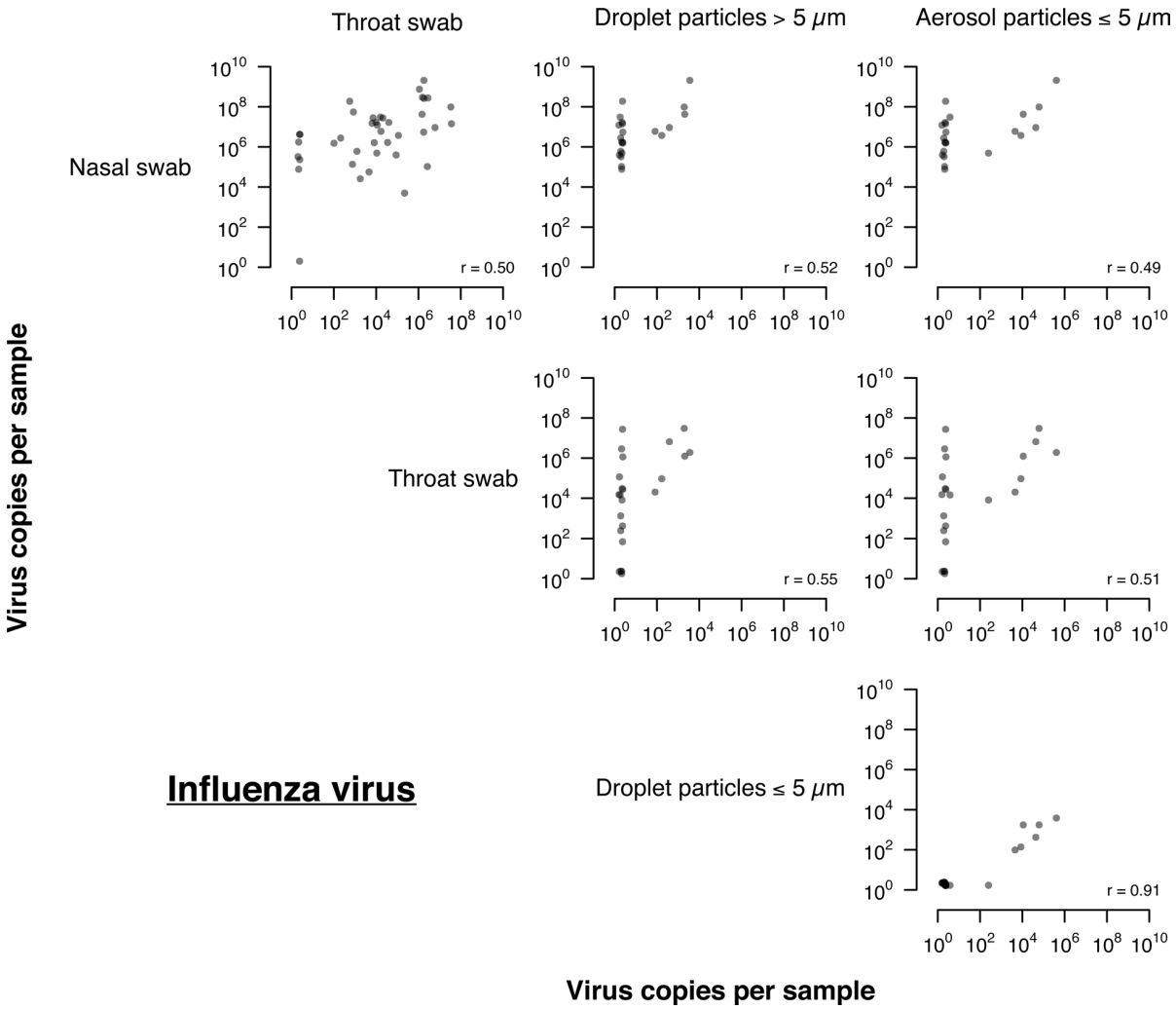
Extended Data Fig. 4 | Efficacy of surgical face masks in reducing respiratory virus shedding in respiratory droplets and aerosols of symptomatic individuals with seasonal coronaviruses including (a) coronavirus NL63, (b) coronavirus OC43 and (c) coronavirus HKU1. The figure shows the virus copies per sample collected in nasal swab (red), throat swab (blue), respiratory droplets collected for 30 min while not wearing (dark green) or wearing (light green) a surgical face mask and aerosols collected for 30 min while not wearing (brown) or wearing (orange) a face mask, collected from individuals with acute respiratory symptoms who were positive for coronavirus NL63, coronavirus OC43 and coronavirus HKU1 as determined by RT-PCR in any samples. *P* values for mask intervention as predictor of $\log_{10}$ virus copies per sample in an unadjusted univariate Tobit regression model which allowed for censoring at the lower limit of detection of the RT-PCR assay are shown, with significant differences in bold. For nasal swabs and throat swabs, all infected individuals were included (coronavirus NL63, n = 8; coronavirus OC43, n = 5; coronavirus HKU1, n = 4). For respiratory droplets and aerosols, numbers of infected individuals who provided exhaled breath samples while not wearing or wearing a surgical face mask, respectively were: coronavirus NL63 (n = 3 and 5), coronavirus OC43 (n = 3 and 4), coronavirus HKU1 (n = 4 and 2). A subset of participants provided exhaled breath samples for both mask interventions (coronavirus NL63, n = 0; coronavirus OC43, n = 2; coronavirus HKU1, n = 2).



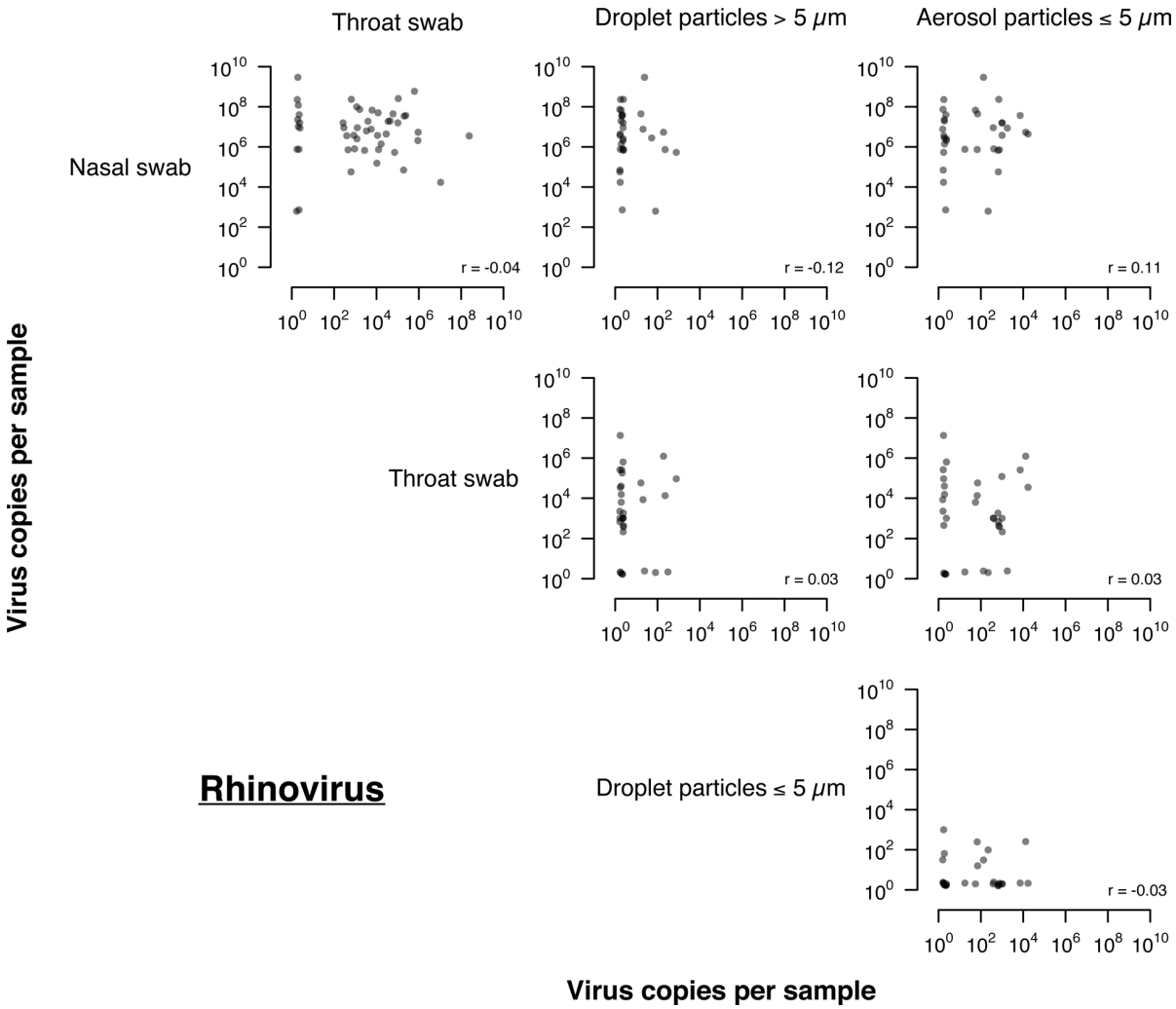
Extended Data Fig. 5 | Efficacy of surgical face masks in reducing respiratory virus shedding in respiratory droplets and aerosols of symptomatic individuals with seasonal influenza viruses including (a) influenza A and (b) influenza B virus. The figure shows the virus copies per sample collected in nasal swab (red), throat swab (blue), respiratory droplets collected for 30 min while not wearing (dark green) or wearing (light green) a surgical face mask and aerosols collected for 30 min while not wearing (brown) or wearing (orange) a face mask, collected from individuals with acute respiratory symptoms who were positive for influenza A and influenza B virus as determined by RT-PCR in any samples. *P* values for mask intervention as predictor of $\log_{10}$ virus copies per sample in an unadjusted univariate Tobit regression model which allowed for censoring at the lower limit of detection of the RT-PCR assay are shown, with significant differences in bold. For nasal swabs and throat swabs, all infected individuals were included (influenza A virus, n = 31; influenza B virus, n = 14). For respiratory droplets and aerosols, numbers of infected individuals who provided exhaled breath samples while not wearing or wearing a surgical face mask, respectively were: influenza A virus (n = 19 and 19), influenza B virus (n = 6 and 10). A subset of participants provided exhaled breath samples for both mask interventions (influenza A virus, n = 7; influenza B virus, n = 2).



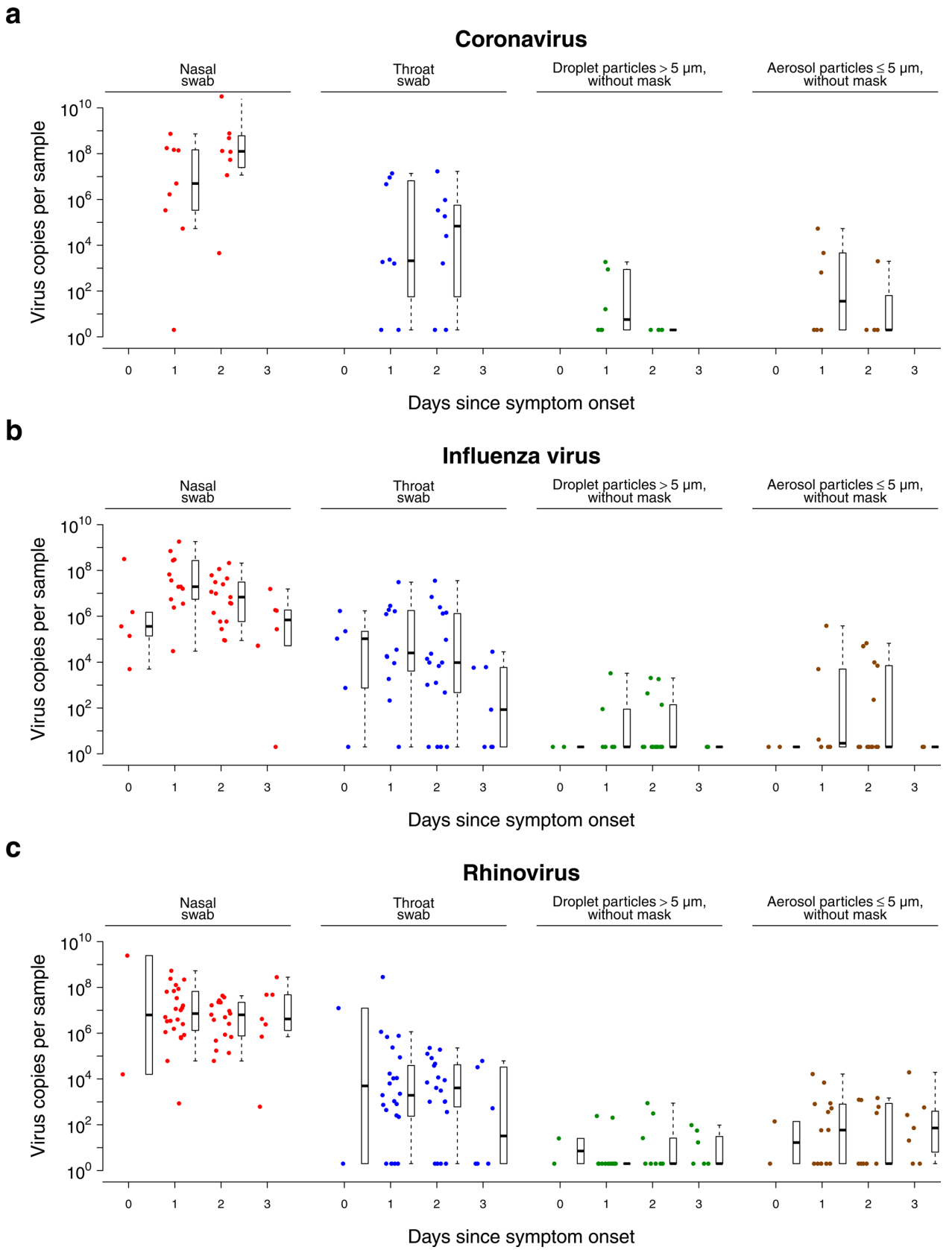
Extended Data Fig. 6 | Correlation of coronavirus viral shedding between different samples (nasal swab, throat swab, respiratory droplets and aerosols) in symptomatic individuals with seasonal coronavirus infection. For nasal swabs and throat swabs, all infected individuals were included (n = 17). For respiratory droplets and aerosols, only infected individuals who provided exhaled breath samples while not wearing a surgical face mask were included (n = 10). r, the Spearman's rank correlation coefficient.



Extended Data Fig. 7 | Correlation of influenza viral shedding between different samples (nasal swab, throat swab, respiratory droplets and aerosols) in symptomatic individuals with seasonal influenza infection. For nasal swabs and throat swabs, all infected individuals were included (n = 43). For respiratory droplets and aerosols, only infected individuals who provided exhaled breath samples while not wearing a surgical face mask were included (n = 23). r, the Spearman's rank correlation coefficient.



Extended Data Fig. 8 | Correlation of rhinovirus viral shedding between different samples (nasal swab, throat swab, respiratory droplets and aerosols) in symptomatic individuals with rhinovirus infection. For nasal swabs and throat swabs, all infected individuals were included (n = 54). For respiratory droplets and aerosols, only infected individuals who provided exhaled breath samples while not wearing a surgical face mask were included (n = 36). r, the Spearman's rank correlation coefficient.



Extended Data Fig. 9 | See next page for caption.

Extended Data Fig. 9 | Respiratory virus shedding in respiratory droplets and aerosols stratified by days from symptom onset for (a) coronavirus, (b) influenza virus or (c) rhinovirus. The figures shows the virus copies per sample collected in nasal swab (red), throat swab (blue), respiratory droplets (dark green) and aerosols (brown) collected for 30 min while not wearing a surgical face mask, stratified by the number of days from symptom onset on which the respiratory droplets and aerosols were collected. For nasal swabs and throat swabs, all infected individuals were included (coronavirus, n = 17; influenza virus, n = 43; rhinovirus, n = 54). For respiratory droplets and aerosols, numbers of infected individuals who provided exhaled breath samples while not wearing or wearing a surgical face mask, respectively were: coronavirus (n = 10 and 11), influenza virus (n = 23 and 28), rhinovirus (n = 36 and 32). A subset of participants provided exhaled breath samples for both mask interventions (coronavirus, n = 4; influenza virus, n = 8; rhinovirus, n = 14). The box plots indicate the median with the interquartile range (lower and upper hinge) and ± 1.5 × interquartile range from the first and third quartile (lower and upper whisker).

nature research

Corresponding author(s): Benjamin John Cowling

Last updated by author(s): Mar 4, 2020

Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see Authors & Referees and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☐	☒	A description of all covariates tested
☐	☒	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒	For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☐	☒	Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	No software was used.
Data analysis	All analyses were conducted with R version 3.6.0 and the VGAM package 1.1.1.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors/reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

Anonymized raw data and R syntax to reproduce all the analyses, figures, tables and supplementary tables in the published article are available at: [Dryad link pending].

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	We estimated a priori the sample size to be 300 participants. The primary outcome of the study was the reduction in the exhaled virus concentration of normal tidal breathing by wearing face mask in terms of total virus by RT-PCR as a proxy for infectious virus particle. We expected that a 1-log reduction in exhaled virus particle by face mask intervention would have a clinically relevant effect in reducing the probability of transmission. Except for influenza, there was no quantitative data available from exhaled breath samples from respiratory virus-infected individuals before the present study. If the standard deviation of exhaled virus concentration was 1 log copies/ml (Milton et al., PLoS Pathog 2013), we would detect a difference of >1 log copies/ml in the mask vs control group as long as we have >15 participants with a specific respiratory virus. For example, if our study included 23 participants with rhinovirus detectable in exhaled breath without a mask, we will have 80% power and 0.05 significance level to identify differences in viral shedding in aerosols of 1.28 log10 copies associated with the use of face masks, assuming a standard deviation of 1.54 log10 copies based on data from nasal and throat swab (Lu et al., J Clin Microbiol 2008). We expected from 300 individuals with ARI, at least 150 to have a respiratory virus, and at least 20-30 to have each of rhinovirus, coronavirus, adenovirus and parainfluenza plus small numbers of other respiratory viruses, assuming the Viral Panel would detect respiratory viruses in 60% of participants including 10% by influenza (since we partly recruited during the influenza seasons) and the other 50% made up of rhinovirus, coronavirus, adenovirus and parainfluenza virus.
Data exclusions	As described in the Results section and Supplementary Figure 1, only participants who provided exhaled breath samples and randomized to mask intervention were included; and final analyses were performed only for participants with either coronavirus, influenza virus or rhinovirus infection, which had sufficient sample size for comparison between mask intervention.
Replication	Samples from a subset of participants identified with a coronavirus, influenza or rhinovirus infection were re-tested by RT-PCR with consistent results. R syntax is available to reproduce all the analyses, figures, tables and supplementary tables in the published article.
Randomization	Prior to the exhaled breath collection, each participant was randomly allocated in a 1:1 ratio to either wearing a surgical face mask or not during the exhaled breath collection using a computer-generated sequence. The allocation was concealed to the study stuff performing the exhaled breath collection before allocation of the mask intervention.
Blinding	Blinding to the participant and the study stuff for the mask intervention was not possible. The study staff performing the statistical analyses was also involved in the data collection. We expected there would be minimal bias due to unblinding since data collection for questionnaires was done before randomization to mask intervention, and viral load from a sample measured by RT-PCR is an objective measurement.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☐	☒ Eukaryotic cell lines
☒	☐ Palaeontology
☒	☐ Animals and other organisms
☐	☒ Human research participants
☐	☒ Clinical data

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Eukaryotic cell lines

Policy information about cell lines

Cell line source(s)	Madin-Darby Canine Kidney (MDCK) cells
Authentication	European Collection of Authenticated Cell Cultures.
Mycoplasma contamination	We confirm that all cell lines tested negative for mycoplasma contamination.
Commonly misidentified lines (See ICLAC register)	Nil

Human research participants

Policy information about studies involving human research participants

Population characteristics	As described in the Results section, Table 1a and Supplementary Table 1, there were some differences in characteristics of participants with the different viruses. Overall, most participants were younger adults and 5% were age 11-17 years, but there were more children with influenza virus and no children in the subgroup with coronavirus infection. Overall, 59% were female, but there were more females among the subgroup with coronavirus infection. The majority of participants did not have underlying medical conditions and overall 9% had received influenza vaccination for the current season but only 2% among those with influenza virus infection. The majority of participants were sampled within 24–48 or 48–72 hours of illness onset. 24% of participants had a measured fever ≥37.8ºC, with influenza patients more than twice as likely than coronavirus and rhinovirus-infected patients to have a measured fever. Coronavirus-infected participants coughed the most with an average of 17 (SD 30) coughs during the 30-minute exhaled breath collection. The profile of the participants randomized to with-mask vs without-mask groups were similar.
Recruitment	As described in the Methods section, participants were recruited year-round from March 2013 through May 2016 in a general outpatient clinic of a private hospital in Hong Kong. As routine practice, clinic staff screened all individuals attending the clinics for respiratory and any other symptoms regardless of the purpose of the visit at the triage. Study staff then approached immediately those who reported at least one of the following symptoms of acute respiratory illness (ARI) for further screening: fever≥37.8ºC, cough, sore throat, runny nose, headache, myalgia and phlegm. Individuals who reported ≥2 ARI symptoms, within 3 days of illness onset and ≥11 years of age were eligible to participate.
Ethics oversight	As described in the Methods section, the study protocol was approved by the Institutional Review Board of The University of Hong Kong and the Clinical and Research Ethics Committee of Hong Kong Baptist Hospital.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	The present study was not registered in clinical trials registries, as it was a laboratory-based study of detection of viruses in exhaled breath and the effect of wearing surgical facemasks on virus detection. It was not a Phase II/III clinical trial.
Study protocol	Not available in clinical trials registries (as above). Study protocol will be made available to editors and peer reviewers if requested.
Data collection	As described in the Methods section, participants were recruited year-round from March 2013 through March 2016 in a general outpatient clinic of a private hospital in Hong Kong. Data collection for questionnaires and exhaled breath sample collection was done face-to-face with the participant by trained study staff at the same clinic on the day of participant enrolment.
Outcomes	As pre-specified in the study protocol, the primary outcomes of the study were the virus generation rate in the tidal breathing of participants infected by different respiratory viruses, and the efficacy of face mask in preventing virus dissemination in exhaled breath especially at the aerosol fraction. As pre-specified in the study protocol, one of the secondary outcomes was to provide indirect evidence for relative importance of different transmission routes of influenza and other respiratory viruses. In this regard, in the present manuscript we examined the correlation between viral shedding in nose swabs, throat swabs, respiratory droplets and aerosols, and factors affecting viral shedding in respiratory droplets and aerosols. As described in the Discussion section in the present manuscript about the limitation of our study, there was large proportion of participants with undetectable viral shedding in exhaled breath for each of the viruses studied, and therefore we were unable to examine the exhaled respiratory virus reduction proportion by chi-squared test, nor the exhaled respiratory virus reduction volume (i.e. viral load) by t-test and linear regression as pre-specified in the study protocol. Instead, we have used Fisher's exact test and Tobit regression for the same purposes respectively.

BRIEF COMMUNICATION
https://doi.org/10.1038/s41591-020-0869-5
nature medicine

Check for updates

Temporal dynamics in viral shedding and transmissibility of COVID-19

Xi He[1,3], Eric H. Y. Lau[2,3]✉, Peng Wu[2], Xilong Deng[1], Jian Wang[1], Xinxin Hao[2], Yiu Chung Lau[2], Jessica Y. Wong[2], Yujuan Guan[1], Xinghua Tan[1], Xiaoneng Mo[1], Yanqing Chen[1], Baolin Liao[1], Weilie Chen[1], Fengyu Hu[1], Qing Zhang[1], Mingqiu Zhong[1], Yanrong Wu[1], Lingzhai Zhao[1], Fuchun Zhang[1], Benjamin J. Cowling[2,4], Fang Li[1,4] and Gabriel M. Leung[2,4]

We report temporal patterns of viral shedding in 94 patients with laboratory-confirmed COVID-19 and modeled COVID-19 infectiousness profiles from a separate sample of 77 infector–infectee transmission pairs. We observed the highest viral load in throat swabs at the time of symptom onset, and inferred that infectiousness peaked on or before symptom onset. We estimated that 44% (95% confidence interval, 30–57%) of secondary cases were infected during the index cases' presymptomatic stage, in settings with substantial household clustering, active case finding and quarantine outside the home. Disease control measures should be adjusted to account for probable substantial presymptomatic transmission.

SARS-CoV-2, the causative agent of COVID-19, spreads efficiently, with a basic reproductive number of 2.2 to 2.5 determined in Wuhan[1,2]. The effectiveness of control measures depends on several key epidemiological parameters (Fig. 1a), including the serial interval (duration between symptom onsets of successive cases in a transmission chain) and the incubation period (time between infection and onset of symptoms). Variation between individuals and transmission chains is summarized by the incubation period distribution and the serial interval distribution, respectively. If the observed mean serial interval is shorter than the observed mean incubation period, this indicates that a significant portion of transmission may have occurred before infected persons have developed symptoms. Significant presymptomatic transmission would probably reduce the effectiveness of control measures that are initiated by symptom onset, such as isolation, contact tracing and enhanced hygiene or use of face masks for symptomatic persons.

SARS (severe acute respiratory syndrome) was notable, because infectiousness increased around 7–10 days after symptom onset[3,4]. Onward transmission can be substantially reduced by containment measures such as isolation and quarantine (Fig. 1a)[5]. In contrast, influenza is characterized by increased infectiousness shortly around or even before symptom onset[6].

In this study, we compared clinical data on virus shedding with separate epidemiologic data on incubation periods and serial intervals between cases in transmission chains, to draw inferences on infectiousness profiles.

Among 94 patients with laboratory-confirmed COVID-19 admitted to Guangzhou Eighth People's Hospital, 47/94 (50%) were male, the median age was 47 years and 61/93 (66%) were moderately ill (with fever and/or respiratory symptoms and radiographic evidence of pneumonia), but none were classified as 'severe' or 'critical' on hospital admission (Supplementary Table 1).

A total of 414 throat swabs were collected from these 94 patients, from symptom onset up to 32 days after onset. We detected high viral loads soon after symptom onset, which then gradually decreased towards the detection limit at about day 21. There was no obvious difference in viral loads across sex, age groups and disease severity (Fig. 2).

Separately, based on 77 transmission pairs obtained from publicly available sources within and outside mainland China (Fig. 1b and Supplementary Table 2), the serial interval was estimated to have a mean of 5.8 days (95% confidence interval (CI), 4.8–6.8 days) and a median of 5.2 days (95% CI, 4.1–6.4 days) based on a fitted gamma distribution, with 7.6% negative serial intervals (Fig. 1c). Assuming an incubation period distribution of mean 5.2 days from a separate study of early COVID-19 cases[1], we inferred that infectiousness started from 12.3 days (95% CI, 5.9–17.0 days) before symptom onset and peaked at symptom onset (95% CI, −0.9–0.9 days) (Fig. 1c). We further observed that only <0.1% of transmission would occur before 7 days, 1% of transmission would occur before 5 days and 9% of transmission would occur before 3 days prior to symptom onset. The estimated proportion of presymptomatic transmission (area under the curve) was 44% (95% CI, 30–57%). Infectiousness was estimated to decline quickly within 7 days. Viral load data were not used in the estimation but showed a similar monotonic decreasing pattern.

In sensitivity analysis, using the same estimating procedure but holding constant the start of infectiousness from 5, 8 and 11 days before symptom onset, infectiousness was shown to peak at 2 days before to 1 day after symptom onset, and the proportion of presymptomatic transmission ranged from 37% to 48% (Extended Data Fig. 1).

Finally, simulation showed that the proportion of short serial intervals (for example, <2 days) would be larger if infectiousness were assumed to start before symptom onset (Extended Data Fig. 2). Given the 7.6% negative serial intervals estimated from the infector–infectee paired data, start of infectiousness at least 2 days before onset and peak infectiousness at 2 days before to 1 day after onset would be most consistent with this observed proportion (Extended Data Fig. 3).

Here, we used detailed information on the timing of symptom onsets in transmission pairs to infer the infectiousness profile of

[1]Guangzhou Eighth People's Hospital, Guangzhou Medical University, Guangzhou, China. [2]World Health Organization Collaborating Centre for Infectious Disease Epidemiology and Control, School of Public Health, University of Hong Kong, Hong Kong, SAR, China. [3]These authors contributed equally: Xi He, Eric H. Y. Lau. [4]These authors jointly supervised this work: Benjamin J. Cowling, Fang Li, Gabriel M. Leung. ✉e-mail: ehylau@hku.hk

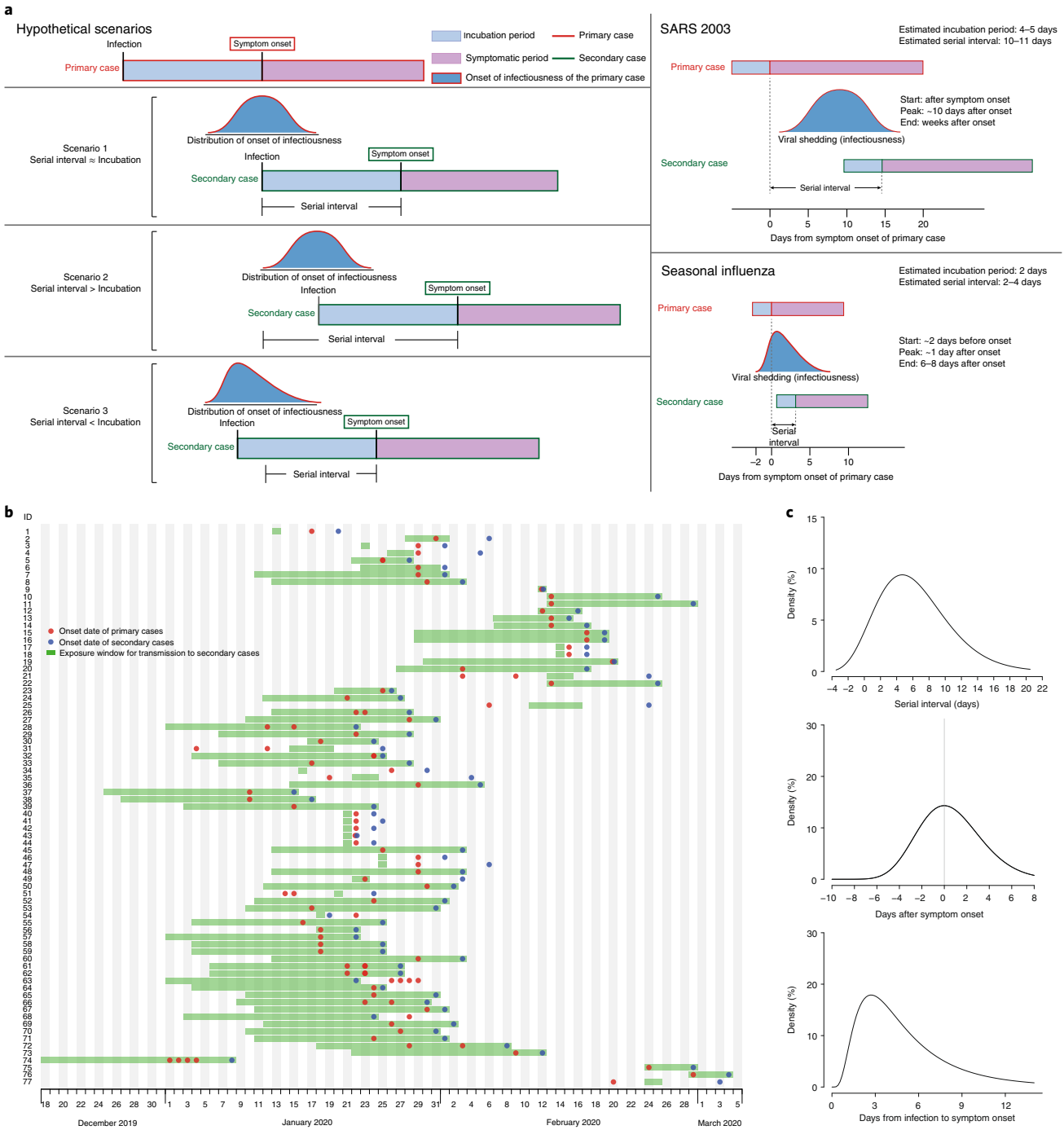


Fig. 1 | Transmission of infectious diseases. a, Schematic of the relation between different time periods in the transmission of infectious disease. **b**, Human-to-human transmission pairs of SAR-CoV-2 virus ($N = 77$). We assumed a maximum exposure window of 21 days prior to symptom onset of the secondary cases. Detailed information on the transmission pairs and the source of information is summarized in Supplementary Tables 2 and 3. **c**, Estimated serial interval distribution (top), inferred infectiousness profile (middle) and assumed incubation period (bottom) of COVID-19.

COVID-19. We showed substantial transmission potential before symptom onset. Of note, most cases were isolated after symptom onset, preventing some post-symptomatic transmission. Even higher proportions of presymptomatic transmission of 48% and 62% have been estimated for Singapore and Tianjin, where active case finding was implemented[7]. Places with active case finding would tend to have a higher proportion of presymptomatic transmission, mainly due to quick quarantine of close contacts and isolation, thus reducing the probability of secondary spread later on in the course of illness. In a rapidly expanding epidemic wherein contact tracing/quarantine and perhaps even isolation are no longer feasible, or in locations where cases are not isolated outside the

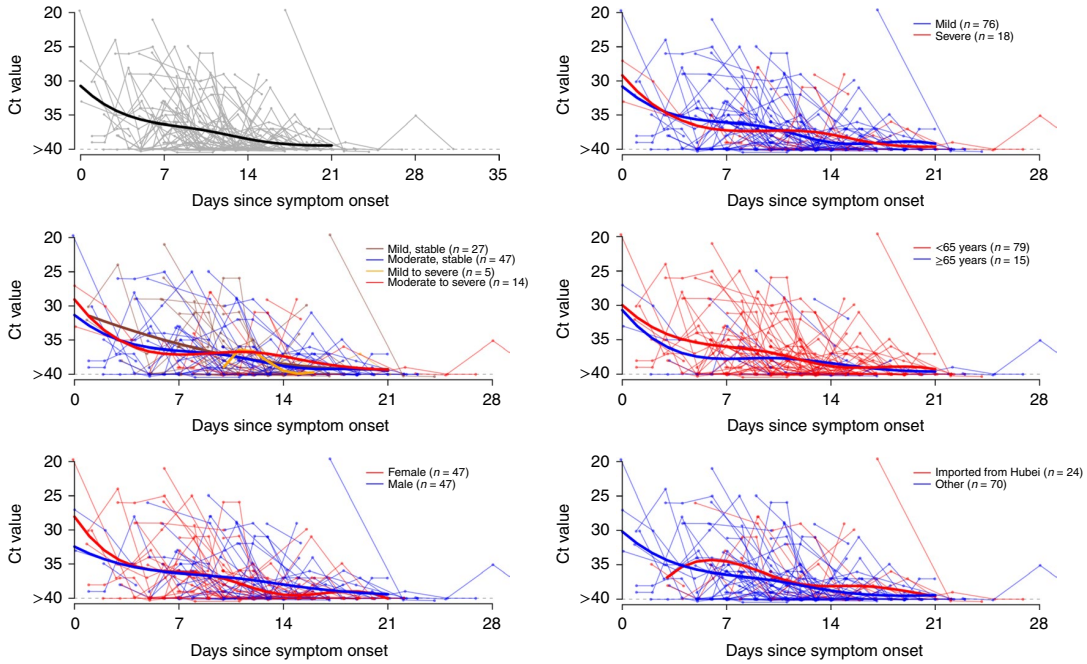


Fig. 2 | Temporal patterns of viral shedding. Viral load (threshold cycle (Ct) values) detected by RT–PCR (PCR with reverse transcription) in throat swabs from patients infected with SARS-CoV-2 ($N = 94$), overall and stratified by disease severity, sex, age group and link to Hubei province. The detection limit was Ct = 40, which was used to indicate negative samples. The thick lines show the trend in viral load, using smoothing splines. We added some noise to the data points to avoid overlaps.

home, we should therefore observe a lower proportion of presymptomatic transmission.

Our analysis suggests that viral shedding may begin 5 to 6 days before the appearance of the first symptoms. After symptom onset, viral loads decreased monotonically, consistent with two recent studies[8,9]. Another study from Wuhan reported that virus was detected for a median of 20 days (up to 37 days among survivors) after symptom onset[10], but infectiousness may decline significantly 8 days after symptom onset, as live virus could no longer be cultured (according to Wölfel and colleagues[11]). Together, these results support our findings that the infectiousness profile may more closely resemble that of influenza than of SARS (Fig. 1a), although we did not have data on viral shedding before symptom onset[6,12]. Our results are also supported by reports of asymptomatic and presymptomatic transmission[13,14].

For a reproductive number of 2.5 (ref. [2]), contact tracing and isolation alone are less likely to be successful if more than 30% of transmission occurred before symptom onset, unless >90% of the contacts can be traced[15]. This is more likely achievable if the definition of contacts covers 2 to 3 days prior to symptom onset of the index case, as has been done in Hong Kong and mainland China since late February. Even when the control strategy is shifting away from containment to mitigation, contact tracing would still be an important measure, such as when there are super-spreading events that may occur in high-risk settings including nursing homes or hospitals. With a substantial proportion of presymptomatic transmission, measures such as enhanced personal hygiene and social distancing for all would likely be the key instruments for community disease control.

Our study has several limitations. First, symptom onset relies on patient recall after confirmation of COVID-19. The potential recall bias would probably have tended toward the direction of under-ascertainment, that is, delay in recognizing first symptoms. As long as these biases did not differ systematically between infector and infectee, the serial interval estimate would not be substantially affected. However, the incubation period would have been overestimated, and thus the proportion of presymptomatic transmission artifactually inflated. Second, shorter serial intervals than those reported here have been reported, but such estimates lengthened when restricted to infector–infectee pairs with more certain transmission links[16]. Finally, the viral shedding dynamics were based on data for patients who received treatment according to nationally promulgated protocols, including combinations of antivirals, antibiotics, corticosteroids, immunomodulatory agents and Chinese medicine preparations, which could have modified the shedding dynamical patterns.

In conclusion, we have estimated that viral shedding of patients with laboratory-confirmed COVID-19 peaked on or before symptom onset, and a substantial proportion of transmission probably occurred before first symptoms in the index case. More inclusive criteria for contact tracing to capture potential transmission events 2 to 3 days before symptom onset should be urgently considered for effective control of the outbreak.

Online content

Any methods, additional references, Nature Research reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at https://doi.org/10.1038/s41591-020-0869-5.

Received: 15 March 2020; Accepted: 1 April 2020;
Published online: 15 April 2020

References

1. Li, Q. et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N. Engl. J. Med.* **382**, 1199–1207 (2020).
2. Wu, J. T., Leung, K. & Leung, G. M. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. *Lancet* **395**, 689–697 (2020).

3. Peiris, J. S. et al. Clinical progression and viral load in a community outbreak of coronavirus-associated SARS pneumonia: a prospective study. *Lancet* **361**, 1767–1772 (2003).
4. Pitzer, V. E., Leung, G. M. & Lipsitch, M. Estimating variability in the transmission of severe acute respiratory syndrome to household contacts in Hong Kong, China. *Am. J. Epidemiol.* **166**, 355–363 (2007).
5. Riley, S. et al. Transmission dynamics of the etiological agent of SARS in Hong Kong: impact of public health interventions. *Science* **300**, 1961–1966 (2003).
6. Ip, D. K. et al. Viral shedding and transmission potential of asymptomatic and paucisymptomatic influenza virus infections in the community. *Clin. Infect. Dis.* **64**, 736–742 (2017).
7. Ganyani, T. et al. Estimating the generation interval for COVID-19 based on symptom onset data. Preprint at *medRxiv* https://doi.org/10.1101/2020.03.05.20031815 (2020).
8. Zou, L. et al. SARS-CoV-2 viral load in upper respiratory specimens of infected patients. *N. Engl. J. Med.* **382**, 1177–1179 (2020).
9. To, K.K.-W. et al. Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: an observational cohort study. *Lancet Infect. Dis.* https://doi.org/10.1016/S1473-3099(20)30196-1 (2020).
10. Zhou, F. et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* **395**, 1054–1062 (2020).
11. Wölfel, R. et al. Virological assessment of hospitalized patients with COVID-2019. *Nature* https://doi.org/10.1038/s41586-020-2196-x (2020).
12. Tsang, T. K. et al. Influenza A virus shedding and infectivity in households. *J. Infect. Dis.* **212**, 1420–1428 (2015).
13. Bai, Y. et al. Presumed asymptomatic carrier transmission of COVID-19. *JAMA* https://doi.org/10.1001/jama.2020.2565 (2020).
14. Tong, Z. D. et al. Potential presymptomatic transmission of SARS-CoV-2, Zhejiang Province, China, 2020. *Emerg. Infect. Dis.*https://doi.org/10.3201/eid2605.200198 (2020).
15. Hellewell, J. et al. Feasibility of controlling COVID-19 outbreaks by isolation of cases and contacts. *Lancet Glob. Health* **8**, e488–e496 (2020).
16. Nishiura, H., Linton, N. M. & Akhmetzhanov, A. R. Serial interval of novel coronavirus (COVID-19) infections. *Int. J. Infect. Dis.* **93**, 284–286 (2020).

Methods

Sources of data. Guangzhou Eighth People's Hospital in Guangdong, China was designated as one of the specialized hospitals for treating patients with COVID-19 at both city and provincial levels on 20 January 2020. After that, many people with COVID-19 were admitted via fever clinics, the hospital emergency room or after confirmation of cases from community epidemiological investigation carried out by the Guangzhou Center for Disease Control and Prevention, or transferred from other hospitals. The first confirmed patient with COVID-19 was admitted on 21 January 2020, but in the initial phase, patients suspected to have COVID-19 were also admitted. We identified all suspected and confirmed COVID-19 cases admitted from 21 January 2020 to 14 February 2020 and collected throat swabs in each case. Patients included those who traveled from Wuhan or Hubei to Guangzhou as well as locals, with cases ranging from asymptomatic, mild to moderate at admission.

The samples were tested by N-gene-specific quantitative RT–PCR assay as previously described[17]. To understand the temporal dynamics of viral shedding and exclude non-confirmed COVID-19 cases, we selected 94 patients who had at least one positive result (cycle threshold (Ct) value < 40) in their throat samples. Serial samples were collected from some but not all patients for clinical monitoring purposes.

We collected information reported on possible human-to-human transmission pairs of patients with laboratory-confirmed COVID-19 from publicly available sources, including announcements made by government health agencies and media reports in mainland China and countries/regions outside China. A transmission pair was defined as two confirmed COVID-19 cases identified in the epidemiologic investigation by showing a clear epidemiologic link with each other, such that one case (infectee) was highly likely to have been infected by the other (infector), by fulfilling the following criteria: (1) the infectee did not report a travel history to an area affected by COVID-19 or any contact with other confirmed or suspected COVID-19 cases except for the infector within 14 days before symptom onset; (2) the infector and infectee were not identified in a patient cluster where other COVID-19 cases had also been confirmed; and (3) the infector and infectee pair did not share a common source of exposure to a COVID-19 case or a place where there were COVID-19 case(s) reported. We excluded possible transmission pairs without a clear exposure history reported prior to symptom onset. Data of possible transmission pairs of COVID-19 were extracted, including age, sex, location, date of symptom onset, type or relationship between the pair cases and time of contact of the cases.

Statistical analysis. We analyzed two separate data sets—clinical and epidemiologic—to assess presymptomatic infectiousness. First, we assessed longitudinal viral shedding data from patients with laboratory-confirmed COVID-19 starting from symptom onset, where viral shedding during the first few days after illness onset could be compared with the inferred infectiousness. Second, the serial intervals from clear transmission chains, combined with information on the incubation period distribution, were used to infer the infectiousness profile, as described in the following.

We present SARS-CoV-2 viral loads in the throat swabs of each patient by day of symptom onset. To aid visualization, a smoothing spline was fitted to the Ct values to summarize the overall trend. Specifically, a generalized additive model, $E(Y) = \beta_0 + s(t)$, with an identity link was fitted, where Y are the Ct values, β_0 is the intercept and $s(t)$ is a cubic spline evaluated at t days after symptom onset. We also compared the viral load by disease severity, age, sex and travel history from Hubei.

We fitted a gamma distribution to the transmission pairs data to estimate the serial interval distribution. We used a published estimate of the incubation period distribution to infer infectiousness with respect to symptom onset from the first 425 patients with COVID-19 in Wuhan with detailed exposure history[1]. We considered that infected cases would become infectious at a certain time point before or after illness onset (t_{S1}). Infectiousness—that is, transmission probability to a secondary case—would then increase until reaching its peak (Fig. 1). The transmission event would occur at time t_1 with a probability described by the infectiousness profile $\beta_c(t_1 - t_{S1})$ relative to the illness onset date, assuming a gamma distribution $\beta(t)$ with a time shift c to allow for start of infectiousness c days prior to symptom onset; that is, $\beta_c(t) = \beta(t + c)$. The secondary case would then show symptoms at time t_{S2}, after the incubation period that is assumed to follow a lognormal distribution $g(t_{S2} - t_1)$. Hence the observed serial intervals distribution $f(t_{S2} - t_{S1})$ would be the convolution between the infectiousness profile and incubation period distribution. We constructed a likelihood function based on the convolution, which was fitted to the observed serial intervals, allowing for the start of infectiousness around symptom onset and window of symptom onset (t_{S1l}, t_{S1u}), given by

$$L(t_{S1u}, t_{S1l}, t_{S2}|\theta) = \int_{t_{S1l}}^{t_{S1u}} \int_{-\infty}^{t_{S2}} \beta_c(t_1 - t_{S1}) g(t_{S2} - t_1) \mathrm{d}t_1 \mathrm{d}t_{S1}$$

A normalization factor can be added to account for the uncertainty in the symptom-onset dates of the index cases. Assuming a uniform distribution, the likelihood would differ only by a multiplicative constant and give the same estimates.

Parameters θ, including the gamma distribution parameters and the start of infectiousness, were estimated using maximum likelihood. The 95% CIs were obtained by bootstrapping with 1,000 replications. We also performed sensitivity analyses by fixing the start of infectiousness from days 5, 8 and 11 before symptom onset and inferred the infectiousness profile.

As an additional check, we simulated the expected serial intervals assuming the same aforementioned incubation period but two different infectiousness profiles, where infectiousness started on the same day and from 2 days before symptom onset, respectively. A recent study isolated live infectious SARS-CoV-2 virus from patients with COVID-19 up to 8 days after symptom onset[11], thus we assumed the same duration of infectiousness. We also assumed that infectiousness peaked on the day of symptom onset. The timing of transmission to secondary cases was simulated according to the infectiousness profile using a lognormal and exponential distribution, respectively, where the serial intervals were estimated as the sum of the onset to transmission interval and the incubation period. We drew random samples for the transmission time relative to symptom onset of the infector $T_1 \approx \beta_c(t)$, and also the incubation period $T_{inc} \approx f(t)$, then the simulated serial interval was $T_1 + T_{inc}$. We also performed simulation considering combinations of different infectiousness profiles, with start of infectiousness 7 days before to 3 days after symptom onset, and peak infectiousness also 7 days before to 3 days after symptom onset. We present the distribution of the serial intervals and proportion of negative serial intervals over 10,000 simulations.

All statistical analyses were conducted in R version 3.6.3 (R Development Core Team).

Ethics approval. Data collection and analysis were required by the National Health Commission of the People's Republic of China to be part of a continuing public health outbreak investigation.

Reporting Summary. Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability

Detailed transmission pairs data in this study are provided in the Supplementary Information and viral shedding data will be available upon request and approval by a data access committee. The data access committee comprises leadership of the Guangzhou Eighth People's Hospital and the Guangzhou Health Commission. There is no restriction to data access.

Code availability

We provided the code for generating Fig. 1c in the Supplementary Information and at https://github.com/ehylau/COVID-19. Other codes are available upon request to the corresponding author.

References

17. Chen, W. et al. Detectable 2019-nCoV viral RNA in blood is a strong indicator for the further clinical severity. *Emerg. Microbes Infect.* **9**, 469–473 (2020).

Acknowledgements

This work was supported by Department of Science and Technology of Guangdong Province (project no. 2020B111108001, to F.L.) and a commissioned grant from the Health and Medical Research Fund from the Government of the Hong Kong Special Administrative Region (to B.J.C.).

Author contributions

X. He, E.H.Y.L., P.W., B.J.C., F.L. and G.M.L. conceived and designed the study. X. He, X.D., J.W., Y.G., X.T., X.M., Y.C. and B.L. were responsible for clinical care and collected all biomaterials. W.C. and F.H. carried out laboratory testing. Q.Z., M.Z. and Y.W. collected and collated linked clinical–epidemiologic data. L.Z., F.Z. and F.L. supervised and coordinated all aspects of the study at Guangzhou Eighth People's Hospital. P.W., X. Hao, Y.C.L. and J.Y.W. collected and verified all infector–infectee transmission data. E.H.Y.L., B.J.C. and G.M.L. wrote the first draft. All authors contributed to data interpretation, critical revision of the manuscript and approved the final version of the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

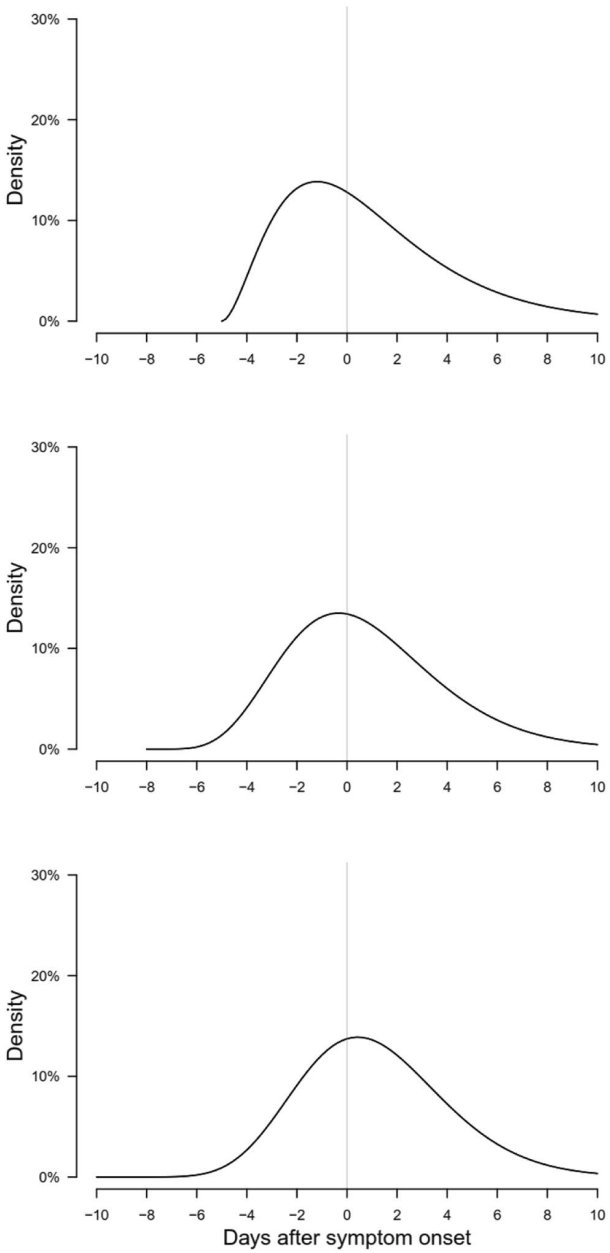
Extended data is available for this paper at https://doi.org/10.1038/s41591-020-0869-5.

Supplementary information is available for this paper at https://doi.org/10.1038/s41591-020-0869-5.

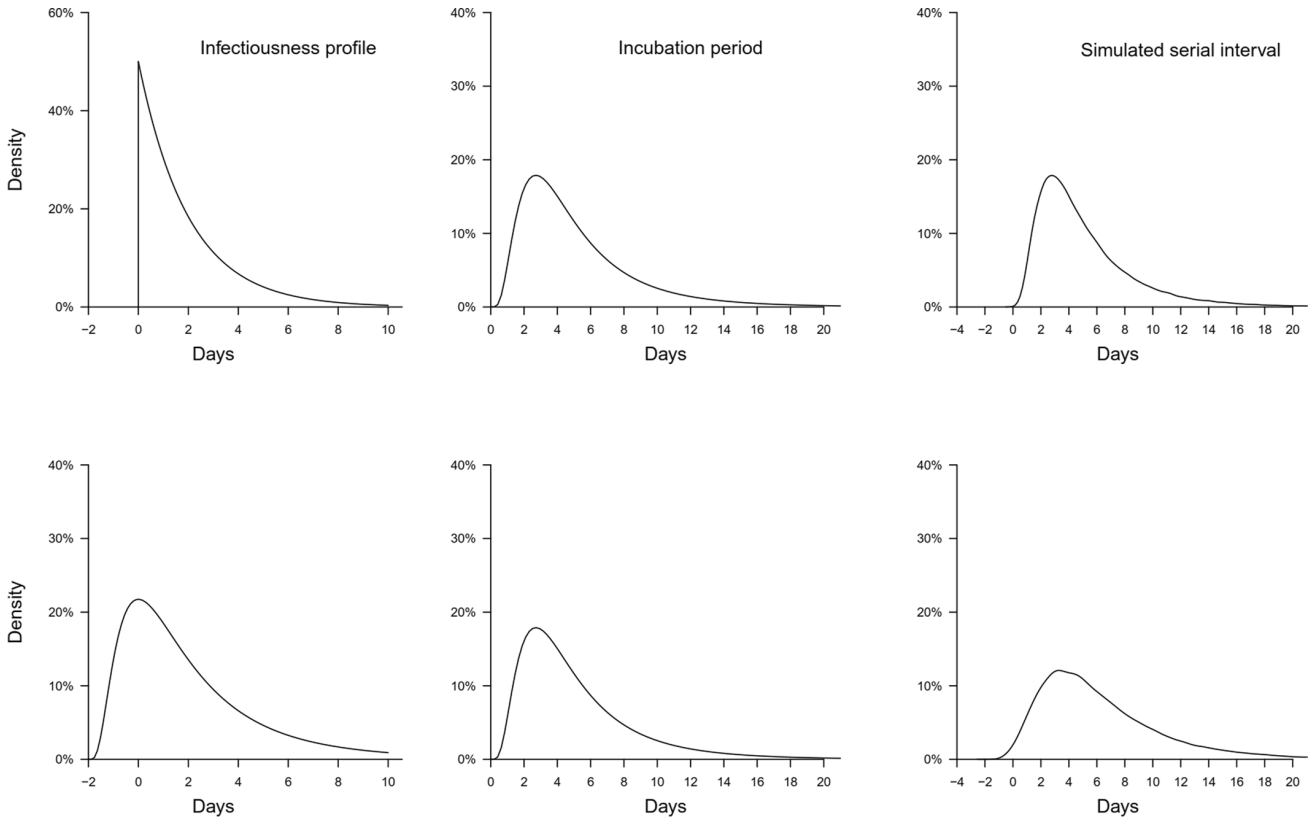
Correspondence and requests for materials should be addressed to E.H.Y.L.

Peer review information Alison Farrell and João Monteiro were the primary editors on this article and managed its editorial process and peer review in collaboration with the rest of the editorial team.

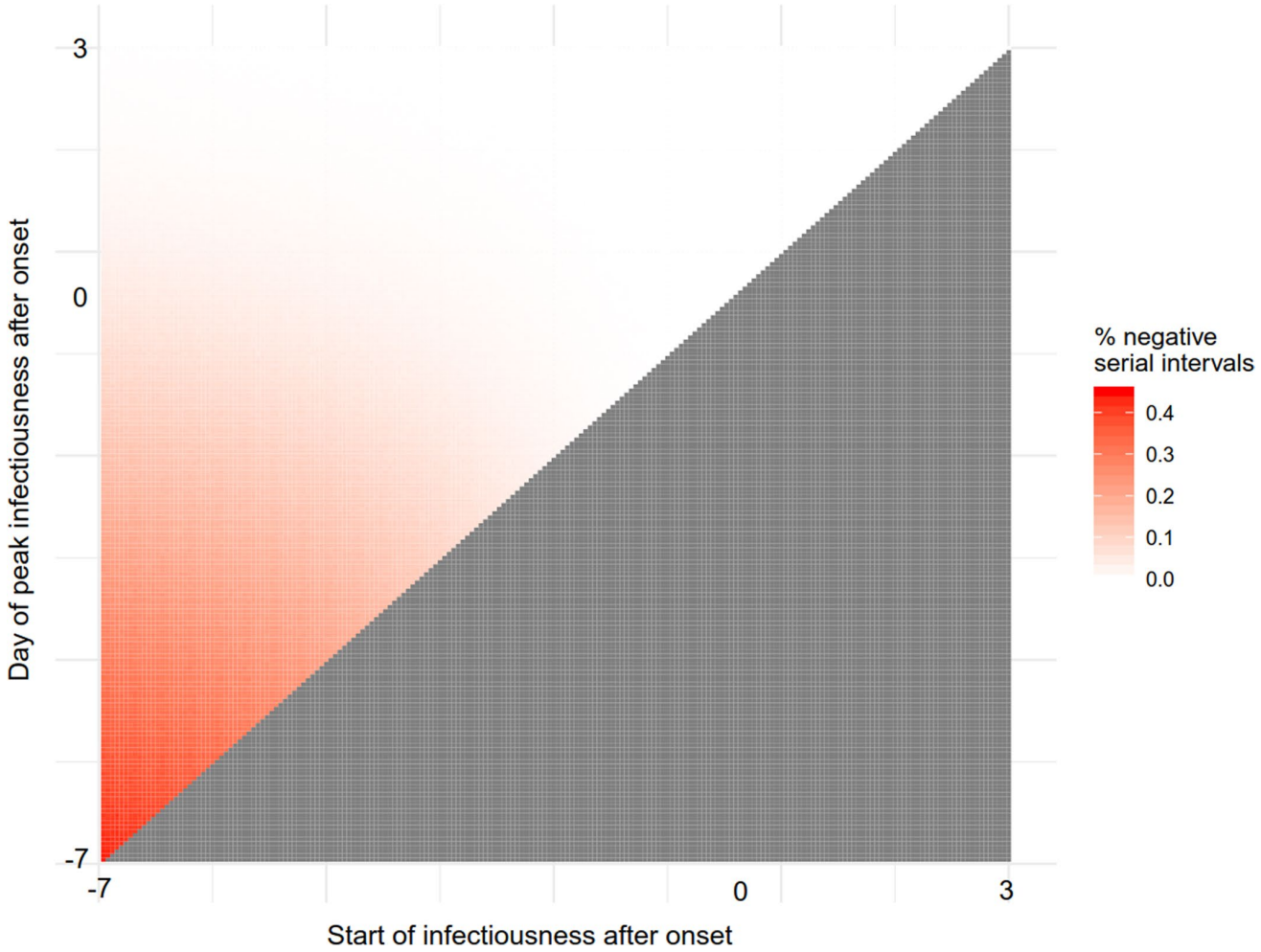
Reprints and permissions information is available at www.nature.com/reprints.



Extended Data Fig. 1 | Inferred infectiousness profile. Infectiousness was assumed to start from 5 days (top) to 8 days (middle) and 11 days (bottom) before symptom onset.



Extended Data Fig. 2 | Simulated serial intervals. Simulated serial intervals assuming infectiousness started on the same day of symptom onset (top panel) and from 2 days before symptom onset (bottom panel) to about 10 days after symptom onset. Both scenarios assumed that infectiousness peaked on the first day of symptom onset.



Extended Data Fig. 3 | Simulated proportions of negative serial intervals. Simulated proportions of negative serial intervals assuming start of infectiousness and peak infectiousness from 7 days before symptom onset to 3 days after symptom onset. From the estimated serial interval distribution based on infector-infectee pairs, 7.6% of the serial intervals were negative. Gray area represents the implausible range where the peak infectious is earlier than the start of infectiousness.

nature research

Corresponding author(s): Eric HY Lau

Last updated by author(s): Mar 28, 2020

Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see Authors & Referees and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☒	☐	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☒	☐	A description of all covariates tested
☒	☐	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☒	☐	For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐	Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	MS Excel 2013.
Data analysis	All statistical analyses were conducted in R version 3.6.2 (R Development Core Team, Vienna, Austria).

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors/reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

Detailed transmission pairs data in this study are given in the supplementary information and viral shedding data will be available upon request and approval by a data access committee. The data access committee comprises leadership of the Guangzhou Eighth People's Hospital and the Guangzhou Health Commission; there is no restriction to data access.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	94 COVID-19 patients who had at least one positive results (Cycle threshold value < 40) by in their throat samples, tested by N-gene-specific quantitative reverse-transcriptase–polymerase-chain-reaction (RT-PCR) assay; 77 infector-infectee pairs from publicly available data
Data exclusions	No data was excluded
Replication	No replication
Randomization	Observational study, no randomization
Blinding	Observational study, no blinding

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology
☒	☐ Animals and other organisms
☐	☒ Human research participants
☒	☐ Clinical data

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Human research participants

Policy information about studies involving human research participants

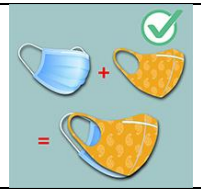
Population characteristics	COVID-19 patients admitted to Guangzhou Eighth People's Hospital
Recruitment	Samples were collected from patients for clinical monitoring purposes.
Ethics oversight	Data collection and analysis were required by the National Health Commission of the People's Republic of China to be part of a continuing public health outbreak investigation.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

BOH192

Understanding Masks to Protect Children Against COVID-19

Less Protective → **Most Protective**

	Cloth Cover	Surgical Mask	Surgical + Cloth	KF94, KN95, FFP2 *Filtration Mask**	N95 *Filtration Mask***
Images: Centers for Disease Prevention and Control (CDC)					
Sizes for ≤12 yrs?	Yes	Yes (ASTM Level 3)	Yes	Yes	No (Adult small available.)
What is this mask designed to protect against?	Droplets (e.g. spray from a cough, sneeze or spit)	Droplets	Droplets	**Droplets and up to at least 94-95% virus aerosols** (i.e. very small particles).	**Droplets and up to at least 95% virus aerosols.**
Benefits	Comfortable, readily available. May have adjustable ear straps or metal nose band to improve fit. Washable	Comfortable, readily available. Has metal nose band to improve fit.	Comfortable, readily available. Surgical mask under cloth face covering applies gentle pressure around edges of surgical mask helping to make a better seal. Two layers impedes more virus particles than a single mask.	Readily available. Better fitting for children and youth. Has metal nose band; some brands have adjustable ear loops to improve fit. Different styles available; some may find one style more comfortable than another.	Readily available. Most protective. May fit high school aged children. Has metal nose band to improve fit. Straps go behind head to make a better seal than ear loops.
Drawbacks	No performance standards exist. Unknown filtration performance. No seal around edges. May allow virus to get through fabric & around mask edge.	Better than cloth but filtration performance depends on the design standard. No seal around edges. May allow virus to get through & around mask edge.	Probably better than a surgical mask or cloth face covering alone. Filtration performance depends on the design standard of surgical mask. No seal around edges. May allow virus to get through & around mask edge.	Possibly somewhat less comfortable. More expensive. **Complies with Korean, Chinese, or European medical device standards.*	May be less comfortable. More expensive. ***Complies with US CDC/NIOSH N95 standard.*

BOH193

Key points when choosing and using masks:

- The more people who wear masks, the more we will all be protected. If a mask wearer has a virus (flu, cold, COVID-19), keeping an infected sneeze and breath covered will benefit everyone.
- If your child is old enough to wear an adult mask, NIOSH-certified N95 respirators offer the best protection. Some manufacturers offer size small, which may fit some children.
- If you select the more protective masks--N95, FFP2, KF94, or KN95—check to make sure the package says it is certified. Some masks are called N95, FFP2, KF94, or KN95 but are not certified to the relevant standard.
    - N95 – U.S. NIOSH standard
    - FFP2 – European standard
    - KF94 – Korean standard
    - KN95 – Chinese standard
- Regardless of mask type, it must fit snuggly to provide the best protection.
    - Headbands (straps that go around the whole head) provide a tighter fit than ear bands.
    - You can knot the mask's ear bands or head band to achieve a tighter fit.
    - Nose bands should be adjusted for a tight fit across the bridge of the nose.
- Double masking (surgical mask under cloth covering) probably offers better protection than either used alone. Some manufacturers offer ASTM Level 3 surgical masks in child sizes.

Useful references:

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/mask-fit-and-filtration.html

FAQs:

Q: What is mask **filtration**?
A: The ability of a mask to trap and hold droplets and aerosols so they are not inhaled.

Q: When we talk about **virus aerosols**, what does that mean?
A: For COVID-19, the aerosol is a suspension of tiny infectious virus particles that can drift around in the air. They are easily inhaled. Aerosols are harder to filter, that's why the more protective masks (N95, FFP2, KN95, KF94) are preferable.

Q: What is a **droplet**?
A: A droplet is larger in size than an aerosol, for example the spray from a cough, sneeze, or spit. Droplets remain in the air for a shorter time and travel much shorter distances than aerosols.

Q: What are the **safer masks**?
A: Look for masks approved for medical use. For any mask, protection relies on proper adjustment for a good tight fit.

Most Protective	**N95***
↓	**FFP2, KN95 & KF94**
↓	**Surgical mask under cloth cover**
↓	**Surgical mask****
Less Protective	**Cloth face covering**

Q: Where can I buy protective masks?
A: Counterfeits can be a problem especially with the N95 and KN95. One source worth considering is: ProjectN95.org

*look for "NIOSH Approved"
**look for "ASTM Level 3" to ensure you are buying a high quality surgical mask

Understanding Masks to Protect Children Against COVID-19

Images: CDC

The more people who wear masks, the more we will all be protected.

Guidance for respiratory protection for children is still evolving. This is to help you understand different types of face coverings & masks and their benefits and shortcomings, so you can make a more informed choice as your children return to school.

Susan Sama, ScD, RN, Epidemiologist
Ann Bauer, ScD, Epidemiologist
John Lindberg, MS, CIH

Who are we? The authors are researchers and parents and this pamphlet summarizes how we choose masks for our families. We received no funding and are not affiliated with or endorsing any companies or products. This does not represent opinions of our employers or funding agencies.

August 12, 2021

BOH194

The NEW ENGLAND JOURNAL of MEDICINE

Perspective

MAY 21, 2020

Universal Masking in Hospitals in the Covid-19 Era

Michael Klompas, M.D., M.P.H., Charles A. Morris, M.D., M.P.H., Julia Sinclair, M.B.A., Madelyn Pearson, D.N.P., R.N., and Erica S. Shenoy, M.D., Ph.D.

As the SARS-CoV-2 pandemic continues to explode, hospital systems are scrambling to intensify their measures for protecting patients and health care workers from the virus. An increasing number of frontline providers are wondering whether this effort should include universal use of masks by all health care workers. Universal masking is already standard practice in Hong Kong, Singapore, and other parts of Asia and has recently been adopted by a handful of U.S. hospitals.

We know that wearing a mask outside health care facilities offers little, if any, protection from infection. Public health authorities define a significant exposure to Covid-19 as face-to-face contact within 6 feet with a patient with symptomatic Covid-19 that is sustained for at least a few minutes (and some say more than 10 minutes or even 30 minutes). The chance of catching Covid-19 from a passing interaction in a public space is therefore minimal. In many cases, the desire for widespread masking is a reflexive reaction to anxiety over the pandemic.

The calculus may be different, however, in health care settings. First and foremost, a mask is a core component of the personal protective equipment (PPE) clinicians need when caring for symptomatic patients with respiratory viral infections, in conjunction with gown, gloves, and eye protection. Masking in this context is already part of routine operations for most hospitals. What is less clear is whether a mask offers any further protection in health care settings in which the wearer has no direct interactions with symptomatic patients. There are two scenarios in which there may be possible benefits.

The first is during the care of a patient with unrecognized Covid-19. A mask alone in this setting will reduce risk only slightly, however, since it does not provide protection from droplets that may enter the eyes or from fomites on the patient or in the environment that providers may pick up on their hands and carry to their mucous membranes (particularly given the concern that mask wearers may have an increased tendency to touch their faces).

More compelling is the possibility that wearing a mask may reduce the likelihood of transmission from asymptomatic and minimally symptomatic health care workers with Covid-19 to other providers and patients. This concern increases as Covid-19 becomes more widespread in the community. We face a constant risk that a health care worker with

early infection may bring the virus into our facilities and transmit it to others. Transmission from people with asymptomatic infection has been well documented, although it is unclear to what extent such transmission contributes to the overall spread of infection.[1-3]

More insidious may be the health care worker who comes to work with mild and ambiguous symptoms, such as fatigue or muscle aches, or a scratchy throat and mild nasal congestion, that they attribute to working long hours or stress or seasonal allergies, rather than recognizing that they may have early or mild Covid-19. In our hospitals, we have already seen a number of instances in which staff members either came to work well but developed symptoms of Covid-19 partway through their shifts or worked with mild and ambiguous symptoms that were subsequently diagnosed as Covid-19. These cases have led to large numbers of our patients and staff members being exposed to the virus and a handful of potentially linked infections in health care workers. Masking all providers might limit transmission from these sources by stopping asymptomatic and minimally symptomatic health care workers from spreading virus-laden oral and nasal droplets.

What is clear, however, is that universal masking alone is not a panacea. A mask will not protect providers caring for a patient with active Covid-19 if it's not accompanied by meticulous hand hygiene, eye protection, gloves, and a gown. A mask alone will not prevent health care workers with early Covid-19 from contaminating their hands and spreading the virus to patients and colleagues. Focusing on universal masking alone may, paradoxically, lead to more transmission of Covid-19 if it diverts attention from implementing more fundamental infection-control measures.

Such measures include vigorous screening of all patients coming to a facility for symptoms of Covid-19 and immediately getting them masked and into a room; early implementation of contact and droplet precautions, including eye protection, for all symptomatic patients and erring on the side of caution when in doubt; rescreening all admitted patients daily for signs and symptoms of Covid-19 in case an infection was incubating on admission or they were exposed to the virus in the hospital; having a low threshold for testing patients with even mild symptoms potentially attributable to a viral respiratory infection (this includes patients with pneumonia, given that a third or more of pneumonias are caused by viruses rather than bacteria); requiring employees to attest that they have no symptoms before starting work each day; being attentive to physical distancing between staff members in all settings (including potentially neglected settings such as elevators, hospital shuttle buses, clinical rounds, and work rooms); restricting and screening visitors; and increasing the frequency and reliability of hand hygiene.

The extent of marginal benefit of universal masking over and above these foundational measures is debatable. It depends on the prevalence of health care workers with asymptomatic and minimally symptomatic infections as well as the relative contribution of this population to the spread of infection. It is informative, in this regard, that the prevalence of Covid-19 among asymptomatic evacuees from Wuhan during the height of the epidemic there was only 1 to 3%.[4,5] Modelers assessing the spread of infection in Wuhan have noted the importance of undiagnosed infections in fueling the spread of Covid-19 while also acknowledging that the transmission risk from this population is likely to be lower than the risk of spread from symptomatic patients.[3] And then the potential benefits of universal masking need to be balanced against the future risk of running out of masks and thereby exposing clinicians to the much greater risk of caring for symptomatic patients without a mask. Providing each health care worker with one mask per day for extended use, however, may paradoxically improve inventory control by reducing one-time uses and facilitating centralized workflows for allocating masks without risk assessments at the individual-employee level.

There may be additional benefits to broad masking policies that extend beyond their technical contribution to reducing pathogen transmission. Masks are visible reminders of an otherwise invisible yet widely prevalent pathogen and may remind people of the importance of social distancing and other infection-control measures.

It is also clear that masks serve symbolic roles. Masks are not only tools, they are also talismans that may help increase health care workers' perceived sense of safety, well-being, and trust in their hospitals. Although such reactions may not be strictly logical, we are all subject to fear and anxiety, especially during times of crisis. One might argue that fear and anxiety are better countered with data and education than with a marginally beneficial mask, par-

ticularly in light of the worldwide mask shortage, but it is difficult to get clinicians to hear this message in the heat of the current crisis. Expanded masking protocols' greatest contribution may be to reduce the transmission of anxiety, over and above whatever role they may play in reducing transmission of Covid-19. The potential value of universal masking in giving health care workers the confidence to absorb and implement the more foundational infection-prevention practices described above may be its greatest contribution.

Disclosure forms provided by the authors are available at NEJM.org.

From the Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute (M.K.), Brigham and Women's Hospital (M.K., C.A.M., J.S., M.P.), Harvard Medical School (M.K., C.A.M., E.S.S.), and the Infection Control Unit and Division of Infectious Diseases, Massachusetts General Hospital (E.S.S.) — all in Boston.

This article was published on April 1, 2020, at NEJM.org.

1. Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. N Engl J Med 2020;382:970-1.
2. Bai Y, Yao L, Wei T, et al. Presumed asymptomatic carrier transmission of COVID-19. JAMA 2020 February 21 (Epub ahead of print).
3. Li R, Pei S, Chen B, et al. Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV2). Science 2020 March 16 (Epub ahead of print).
4. Hoehl S, Rabenau H, Berger A, et al. Evidence of SARS-CoV-2 infection in returning travelers from Wuhan, China. N Engl J Med 2020;382:1278-80.
5. Ng O-T, Marimuthu K, Chia P-Y, et al. SARS-CoV-2 infection among travelers returning from Wuhan, China. N Engl J Med 2020;382:1476-8.

DOI: 10.1056/NEJMp2006372